

PUBLIC COMMENT  
FEASIBILITY STUDY REPORT

SUMMIT NATIONAL SITE  
DEERFIELD, OHIO

EPA WA 57-5L04  
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## EXECUTIVE SUMMARY

The Summit National Site is in Deerfield Township, Portage County, Ohio. It was determined by the United States Environmental Protection Agency (U.S. EPA) and the Ohio Environmental Protection Agency (OHIO EPA) that the site potentially contained hazardous wastes resulting from improper past disposal practices. Because of the possibility of human and environmental exposure to contaminants on the site, as well as the potential for migration of the hazardous materials from the site, the site was included by U.S. EPA on the National Priorities List of uncontrolled hazardous waste sites under the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA). The authority to list, investigate, and remediate hazardous waste sites under CERCLA has been extended and amended by the Superfund Amendments and Reauthorization Act of 1986 (SARA).

The Feasibility Study (FS) report summarizes the process used to develop and evaluate remedial action alternatives for the Summit National Site. In accordance with the NCP, the appropriate extent of remedy is defined as a "cost-effective remedial alternative that effectively mitigates and minimizes threats to and provides adequate protection of public health and welfare and the environment" [40 CFR 300.68(i)].

This FS is based on the information and data presented in the Final RI Report issued by EPA on February 1, 1988.

The methodology used in this FS report allows a step-by-step evaluation of technologies, alternatives, and assembled alternatives by progressing through a series of screenings. Initially, general qualitative information is used. Subsequently, more refined and quantitative information is used to eliminate from consideration infeasible or otherwise unacceptable actions. This methodology provides a systematic procedure for specifying criteria, identifying and evaluating alternatives, and determining the magnitude and importance of effects resulting from the implementation of an action, and considering measures to mitigate adverse effects.

## SITE DESCRIPTION

The Summit National Site is located in Deerfield Township, Portage County, Ohio, approximately 45 miles southeast of Cleveland and 20 miles west of Youngstown. See Figure E-1.

The Summit National Site is approximately rectangular in shape and occupies approximately 11.5 acres at the southeast corner of the intersection of Ohio Route 225 to the west and U. S. Route 224 to the north. See Figure E-2.

The site was a coal strip mine and contained a coal wash pond and coal stock pile prior to its use as an incinerator site. The coal tipple remains as a 15 ft. high embankment in the northwest corner of the site with a loading dock and concrete debris remaining from the original coal processing facilities. Other prominent features on site are two ponds located in the midsection of the site, an abandoned incinerator and two buildings in the southeast corner, a scale house in the northwest corner, and two dilapidated buildings in the northeast corner. Additionally, it is estimated that approximately 900-1,600 drums and two known tanks remain buried on site. Little vegetation is growing on site since most of the site was graded following periodic surface cleanup activities which were performed from 1980 through 1982. The site is enclosed by a 6 ft. high fence with two locked gates for entrance from Route 224 and one locked gate for entrance from Route 225.

## PRIOR REMEDIAL ACTIONS

From early spring to late fall of 1980, Ohio EPA contracted to fence the site, to grade the site to control surface water runoff and runoff and near-surface groundwater flow, to identify and stage about 2,000 drums of wastes, to sample and analyze the contents of several bulk tanks, and to install and develop groundwater monitoring wells (two on site, four off site). During the fall of 1980, the U.S. EPA funded the removal of three bulk tanks and their contents (approximately 7,500 gallons), some contaminated soil, and the treatment of contaminated water. In 1980 and 1981, several of the companies that had previously used Summit's services identified themselves and voluntarily removed wastes they had sent to the site for disposal.

A surface waste cleanup was conducted at the site from fall of 1981 through late spring of 1982 by three waste generators and the state of Ohio. This cleanup included removal and treatment or offsite disposal of all surface drums, bulk tanks, containers, the concrete block pit, and

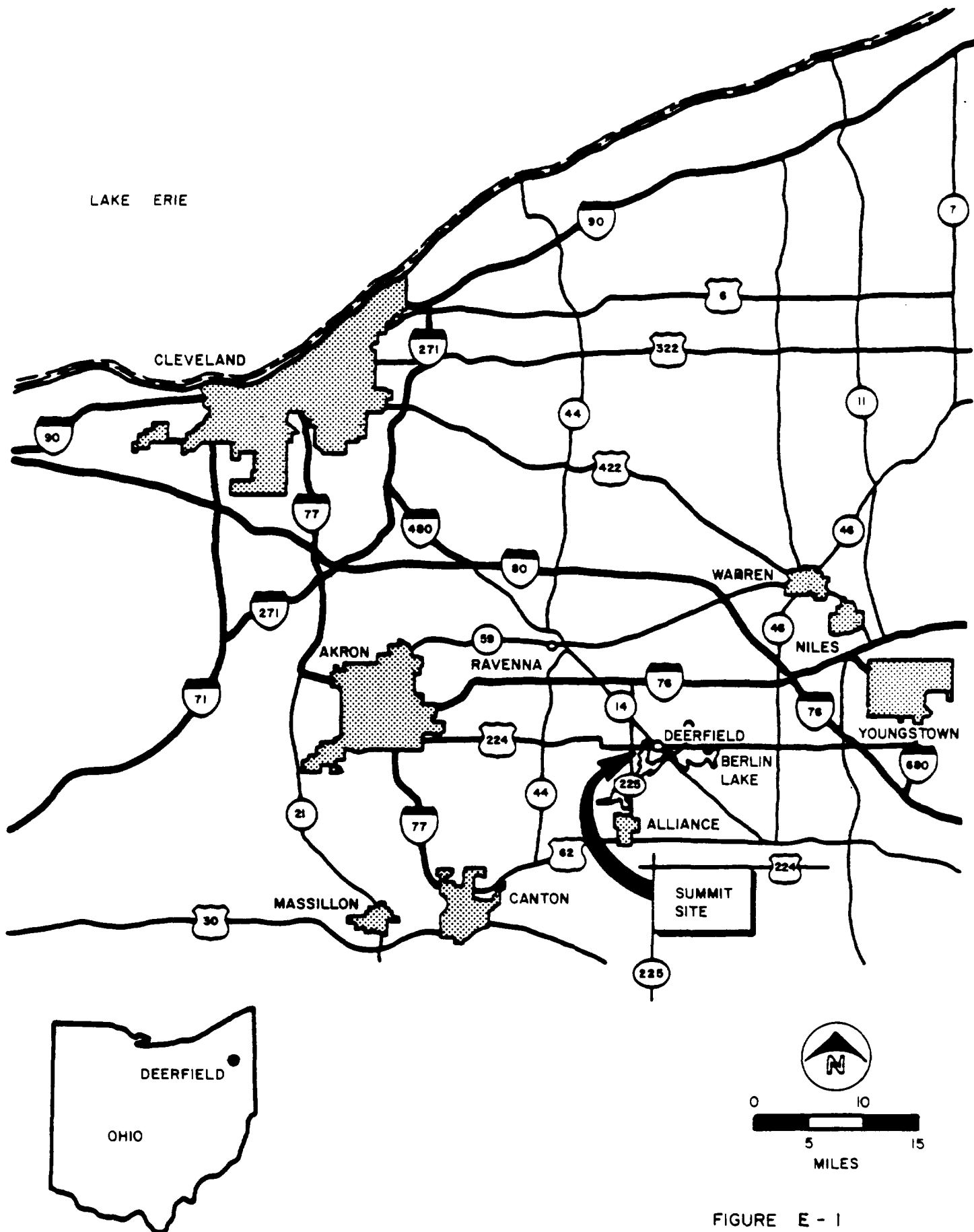
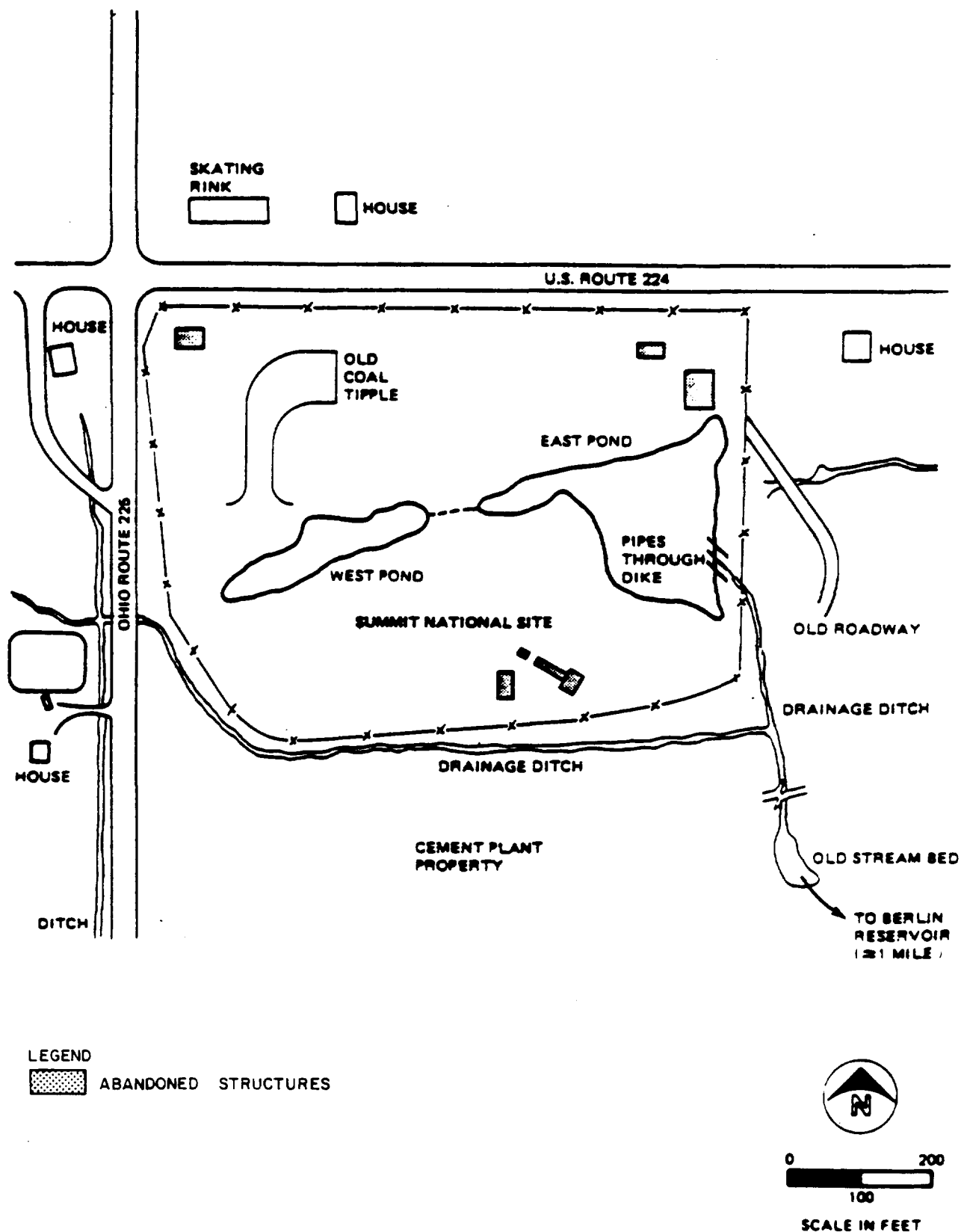


FIGURE E - 1  
SUMMIT SITE LOCATION  
SUMMIT NATIONAL FS



NOTE: ALL LOCATIONS OF STRUCTURES AND PHYSICAL FEATURES APPROXIMATE.

SOURCE: MODIFIED FROM USEPA

FIGURE E-2  
SITE MAP  
SUMMIT NATIONAL FS



their contents. Some incidental contaminated soil removal was necessary as part of the cleanup operation, but soil removal was not extensive. The 1981-82 surface cleanup project removed much of the source of site contamination, but did not include subsurface exploration or cleanup. During the site cleanup, the Ohio EPA identified several areas potentially containing buried drums and/or tanks.

During the Spring of 1987, the U.S. EPA Region V Emergency Response Section was on site responding to an emergency situation related to periodic overflows from the east pond onto the adjacent residential property. Emergency work included the excavation and disposal of a buried tank containing hazardous materials located north of the incinerator. The work was performed in conjunction with the U. S. EPA Region V Technical Assistance Team (TAT).

#### CURRENT SITE STATUS

The following is a summary of major findings from Phase I and II of the Remedial Investigation:

#### SUMMARY OF THE PHASED RI

The field activities performed during the Summit National Remedial Investigation were conducted in two separate phases. Phase I RI activities were conducted during October, November and December, 1984. Phase II RI activities were conducted in two separate episodes during December 1985 through January 1986 and June 1986 through September 1986.

During the Phase I RI the following activities were performed:

- A geophysical study
- Monitoring well installation and groundwater sampling
- Hydrogeologic testing
- Onsite and offsite surface water sampling
- Onsite and offsite sediment sampling
- Onsite surface soil sampling
- Residential well sampling
- Onsite tank sampling
- Air sampling

During the Phase II-A RI the following activities were performed:

- Monitoring well installation
- Onsite subsurface soil sampling and screening
- Offsite surface soil sampling

- Test pit excavation
- Buried drum and tank sampling

During the Phase II-B RI the following activities were performed:

- Monitoring well installation
- Hydrogeologic testing
- Tipple well rehabilitation
- Surface water sampling
- Sediment sampling
- Soils sampling
- Residential well sampling
- Structure survey
- RI derived waste disposal

#### MAJOR FINDINGS

The following section presents the major findings and conclusions for each of the media sampled based on the results from the data obtained.

The hydrogeology of the Summit National site is complex. For purposes of discussion and analysis, the strata at the site has been separated into three hydrogeologic units; the water table aquifer, the "intermediate" units, and the Upper Sharon "aquifer," as shown on Figure E-3.

Groundwater flow directions were developed from numerous water level measurements obtained throughout the RI. Groundwater in the water table aquifer beneath the site flows southward and eastward and does not vary much on a seasonal basis. There is also some northeasterly flow on the northern portion of the site. The water table is generally 5 to 12 ft. below grade. A french drain was installed around the site at an estimated depth of 15 to 20 ft. below grade. It is probable that groundwater in the water table discharges to the onsite ponds, the french drain and the marshy area adjacent to the eastern portion of the site. All of these features are shallow and groundwater also probably continues flowing southward, eastward and northeasterly from the site until lower elevations are encountered.

Groundwater flow direction in the intermediate group cannot be characterized as one unit due to the high heterogeneity of the strata in this zone. Separating the group into strata above and below the unnamed limestone indicates that lateral flow is southeastward in the upper portion and westward in the lower portion. Groundwater in the Upper Sharon aquifer flows northward.

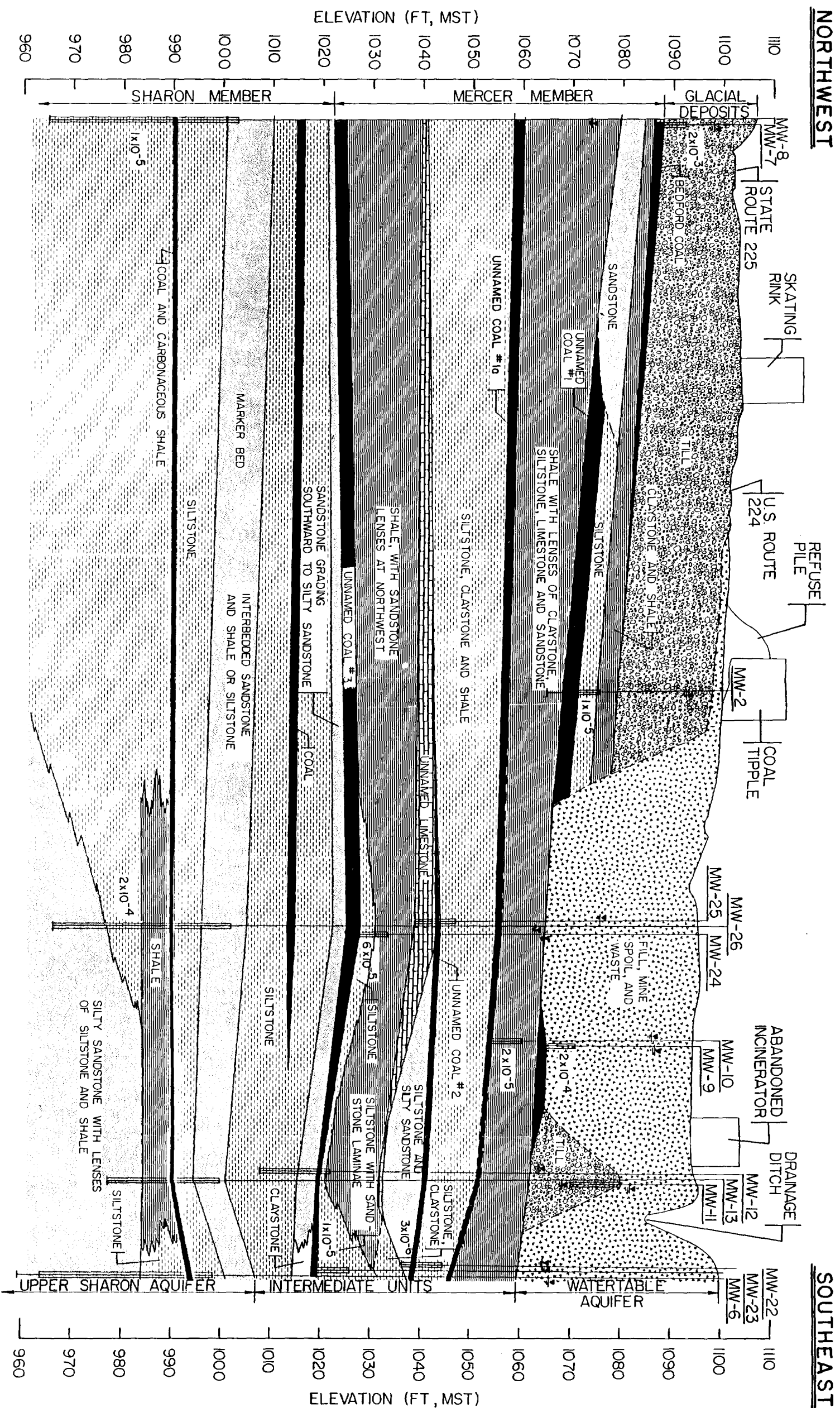


FIGURE E-3  
GENERAL GEOLOGIC SECTION  
SUMMIT NATIONAL F.S

Vertical gradients within bedrock vary across the study area. The gradient between the water-table aquifer and all deeper strata is downward at all locations. In bedrock, vertical components are upward at the southern portion of the site and downward in the central portion.

Shallow onsite groundwater in the water-table aquifer and uppermost intermediate units is contaminated with a number of organic compounds, including 2-butanone, phenol, toluene, and bis (2-ethyl hexyl) phthalate. The highest concentration of these contaminants occur in the southwestern quarter of the site and generally decrease across the southern half of the site, from west to east.

Of the deeper intermediate wells, levels of contaminants were detected in only MW-24. Wells in the Upper Sharon aquifer do not present contamination problems. None of the residential wells, which represent water in the intermediate unit and Upper Sharon aquifer, indicated levels of organic contaminants above background.

The background soils representing local residential, farm and strip mine soil had detectable levels of numerous organic and inorganic compounds. The origins of these contaminants were not able to be determined from the data obtained during the RI.

The onsite surface and subsurface soils (down to 8 ft.) were found to have levels of numerous organic and inorganic contaminants. Many of these contaminants were not observed offsite, and some were found at levels up to several orders of magnitude above background based on comparison to all background and to residential background alone, indicating a site related contamination problem. Offsite soils south of the site at the cement plant also contained numerous polynuclear aromatic hydrocarbons (PAH's) and other organics at levels above background. The eastern offsite soils also showed contamination, particularly PCB, at levels that exceeded background concentrations.

Surface water flow at and near the site was observed to occur only in response to seasonal precipitation events. Therefore, no reliable flow estimates or stream loading characteristics could be made. The onsite surface water was found to be contaminated. The east pond (Figure E-2) had consistently higher levels of contaminants than the west pond, based on total fraction concentration. Offsite surface water is also contaminated with organics and metals at concentrations above background. The major areas of contamination are the south ditch (downstream) and the lower east drainage ditch (Figure E-2).

Onsite sediments are contaminated with organic and inorganic compounds at concentrations that exceeded background soil concentrations. The west pond (Figure E-2) had higher concentrations of volatile organic contaminants while the east pond had higher levels of inorganic contaminants. This is opposite of the surface water results. The offsite sediment in the southern ditch (upstream and downstream) and lower east drainage ditch (Figure E-2) were found to have levels of organics that exceeded background. Some contamination was found in the first and second impoundments located off site to the southeast. Based on the analytical results and current drainage pattern, the second impoundment is currently probably more affected by the adjacent landfill and mine spoil piles, rather than the Summit site. During the active incineration activities from April 1974 through 1975, the second impoundment was hydraulically connected directly to the site drainage. The landfill to the south filled in the old strip pit sometime after 1975. The low level of sediment contamination in the second impoundment could have been deposited during that period.

The interpretation of results of the air sampling and air monitoring performed during the RI suggested that onsite or offsite air contamination had not occurred, and should not occur unless there is a surface disturbance of the site. Radiation in excess of background was not detected onsite.

In general, the permanent structures remaining on site (Figure E-2) are in poor condition, but some could serve as temporary storage facilities if needed during some future site activities.

The buried materials at the site include four tanks and an estimated 900 to 1,600 drums. The estimated total number of drums existing intact that may contain waste is 675 to 1,200.

In the public health evaluation it was determined that risks to human health may exist at the Summit National site under a number of exposure scenarios. Potential pathways of exposure to contaminants originating at the Summit National site under both current and future use conditions were evaluated. A summary table showing potential risks associated with the site is presented in Table E-1. Under current-use conditions, trespasser exposure to onsite surface soil through incidental ingestion, as well as exposure to workers along the southern perimeter of the site and residents along the eastern perimeter through incidental ingestion of soils, were determined to be

TABLE E-1

## SUMMARY OF POTENTIAL RISKS ASSOCIATED WITH THE SUMMIT NATIONAL SITE

Exposure Scenario	<u>Total Cancer Risks</u>		<u>Noncarcinogenic Hazard Index</u>	
	Average	Plausible Maximum	Average	Plausible Maximum
<u>Current Conditions - Soil</u>				
On-site trespassers	$1 \times 10^{-8}$	$3 \times 10^{-5}$	<1	<1
Off-site workers (southern perimeter)	$6 \times 10^{-7}$	$4 \times 10^{-5}$	<1	<1
Off-site residents (eastern perimeter)	$3 \times 10^{-6}$	$2 \times 10^{-4}$	<1	<1
<u>Current Conditions - Sediment</u>				
Children in ditches	$2 \times 10^{-7}$	$6 \times 10^{-6}$	<1	>1
Teenagers in second impoundment	$6 \times 10^{-12}$	$1 \times 10^{-7}$	<1	<1
<u>Future Conditions</u>				
On-site workers				
Soil	$2 \times 10^{-7}$	$2 \times 10^{-4}$	<1	<1
Groundwater				
Water Table	$5 \times 10^{-5}$	$3 \times 10^{-2}$	>1	>1
Intermediate Unit	$2 \times 10^{-5}$	$1 \times 10^{-3}$	<1	>1
Upper Sharon Aquifer	$4 \times 10^{-9}$	NA	<1	NA
On-site residents				
Soil	$1 \times 10^{-5}$	$5 \times 10^{-3}$	<1	>1
Groundwater				
Water Table	$1 \times 10^{-3}$	$3 \times 10^{-1}$	>1	>1
Intermediate Unit	$4 \times 10^{-4}$	$2 \times 10^{-2}$	<1	>1
Upper Sharon Aquifer	$8 \times 10^{-8}$	NA	<1	NA

NA = not applicable, only one representative sample.

complete pathways with a moderate potential for significant exposure. The results of a quantitative estimation of the risks associated with these pathways show that for onsite workers and workers along the southern perimeter, the potential excess lifetime cancer risks under the average exposure conditions are less than  $10^{-6}$  for exposure to carcinogens. The potential excess lifetime cancer risks for residents along the eastern perimeter are  $3 \times 10^{-6}$  for the exposure scenarios evaluated. However, for the plausible maximum exposures, the total excess cancer risk exceeds  $10^{-6}$  for each of these three scenarios by at least one order of magnitude. For both the average and plausible maximum cases of each of these three exposure scenarios, noncarcinogenic health effects are not likely to result from exposure.

Under current-use conditions, exposure of local residents to sediments in the ditches and second impoundment through incidental ingestion of soils was quantitatively evaluated. The potential excess lifetime cancer risks to children through the incidental ingestion of sediment in ditches under the average conditions evaluated, and to teenagers in the second impoundment under both average and plausible maximum exposure conditions are less than  $10^{-6}$  for exposure to carcinogens. However, for the plausible maximum exposure of children in ditches, the potential excess lifetime cancer risk is  $6 \times 10^{-6}$ . In addition, the total hazard index for exposure of children in ditches exceeds one under the plausible maximum exposure scenario evaluated, indicating that noncarcinogenic health effects may also result from exposure to chemicals in the ditches. For the other three exposure scenarios involving exposure to sediment, noncarcinogenic health effects are not likely to result from exposure. Exposure to surface water was not quantitatively evaluated because the surface water bodies near the site are for drainage only and are not used as a source of potable water or for recreational purposes on a regular basis. Because surface water flow only occurs in response to precipitation, exposure to surface water will occur very infrequently, if at all, and there would be little, if any, potential for repeated exposure to occur through contact with surface water.

If the Summit National site is reused in the future for light industrial work or a residential dwelling, exposure to onsite soil through direct contact and incidental ingestion may occur. Additionally, exposure to groundwater in any one of the three water-bearing units beneath the site may occur through ingestion. Estimation of risk to workers associated with incidental ingestion of onsite

soils indicates the total excess cancer risks exceed  $10^{-6}$  for the plausible maximum, but not the average conditions evaluated. This evaluation indicated that noncarcinogenic health effects are not likely to result from this type of exposure to the indicator chemicals present in onsite soils.

The total excess cancer risks to workers associated with ingestion of groundwater from the water-table aquifer, and intermediate unit, exceed  $10^{-6}$  under average and plausible maximum exposure conditions. In addition, the total hazard index for exposure under average and plausible maximum conditions to the water table aquifer and the plausible maximum exposure conditions to the intermediate unit exceed one, indicating that noncarcinogenic health effects also may result from exposure to chemicals in these units.

Estimation of risk to residents associated with lifetime incidental ingestion of onsite soils indicates the total excess cancer risks exceed  $10^{-6}$  for both the average and plausible maximum exposure conditions evaluated. In addition, under the plausible maximum exposure conditions, noncarcinogenic health effects may also result from exposure to the indicator chemicals present in the onsite soils.

The total excess cancer risks to residents associated with lifetime ingestion of groundwater from the water table and intermediate unit exceed  $10^{-6}$  under the average and plausible maximum exposure conditions. In addition, the total hazard index for exposure under average and plausible maximum exposure conditions to the intermediate unit exceed one, indicating that noncarcinogenic health effects also may result from exposure to chemicals in these units.

At the request of EPA Region V, exposures to offsite background soils were evaluated. In estimating exposure of residents to background concentrations of chemicals in the vicinity of the Summit National site, the conservative assumption is made that an individual could be exposed throughout an entire lifetime. The total cancer risks associated with incidental ingestion of soil over a lifetime exceeds  $10^{-6}$  for a plausible maximum exposure, and is equal to  $10^{-6}$  for the average exposure evaluated. Noncarcinogenic health effects are not likely to result from exposure to these background chemicals.



## DEVELOPMENT AND SCREENING OF REMEDIAL TECHNOLOGIES AND POTENTIAL ALTERNATIVES

Remedial technologies are identified in terms of general response actions that address the site problems as defined by the remedial goals. These remedial technologies are then screened to eliminate those technologies that are inapplicable. The specific methodology includes identifying:

- Remedial action goals, including site-specific applicable or relevant and appropriate requirements (ARARs), based on site contaminated media and the results of the public health evaluation for existing conditions.
- General response actions that meet the remedial goals.
- Possible technologies for each general response action, followed by the screening of these technologies to eliminate infeasible technologies.

The nature and extent of site hazards summarized in the Summit RI form the basis for identifying specific objectives for remediating contaminated soil and subsurface wastes (buried drums and tanks), sediment, surface water, and groundwater and associated free product. The risks identified at the site in the public health risk assessment (summarized in Chapter 2) establish the basis for identifying site-specific goals of remedial measures. The public health risk assessment identified either existing or potential future public health or environmental risks in the following media: soil, sediment, and groundwater. The following goals for the Summit National Site identify the receptors to be protected, the exposure route, the area of existing or potential hazards, and the contaminants of concern.

## DESCRIPTION OF ASSEMBLED ALTERNATIVES

Based on screening and detailed analysis of remedial alternatives for the Summit National Site, several assembled remedial alternatives, including the no action alternative, were developed. The following assembled remedial alternatives represent a range of remediation applicable to the Summit National Site.

#### ALTERNATIVE NO. 1 - NO ACTION

The No Action alternative is required by the NCP to be carried through to detailed analysis of alternatives and provides a baseline for comparison of other alternatives. This alternative would result in the public health and environmental risks identified in the public health evaluation included in the risk assessment in Chapter 2 of this report.

#### ALTERNATIVE NO. 2 - RESIDENT RELOCATION WITH MONITORING

This alternative includes access and deed restrictions, relocating the Watson residence bordering the eastern portion of the site 200 ft. to the east, and run off and groundwater monitoring.

This alternative is intended to represent a minimum action alternative which would offer protection for that portion of the public currently at a direct risk from known existing site hazards. The potential risks that the residents located along the eastern perimeter are exposed to are in excess of a  $10^{-6}$  total cancer risk. The mobility, toxicity, or volume of the wastes or contaminated materials is unaffected by this alternative, and a major existing contaminant source (buried drums and tanks) would remain on site.

#### ALTERNATIVE NO. 3 - CAPPING WITH DRUM INCINERATION

The major components of this alternative are: excavation and offsite incineration of the contents of buried drums and tanks; construction of a RCRA cap over the site to reduce contact with contaminated materials; construction of a soil-bentonite slurry wall to limit migration of contaminated groundwater; lowering of the Water Table Aquifer by the use of 220 wellpoints; extraction of contaminated groundwater from the Upper Intermediate Unit by 12 wellpoints; and access restrictions, monitoring, and resident relocation as described in Alternative 2.

All operable unit goals are addressed in this alternative. It is intended to be representative of a low-cost containment alternative that offers protection to public health and environment from known existing site hazards. The mobility, toxicity, or volume of the wastes or contaminated materials are reduced in this alternative by the offsite incineration of the contents of buried drums and tanks. Access restrictions, monitoring and resident relocation would be the same as discussed for Alternative 2.

Long-term maintenance would be required for the multi-layer cap and site fencing, and monitoring would be ongoing.

Groundwater extraction and treatment will be the same in subsequent alternatives.

#### ALTERNATIVE 4 - ONSITE RCRA LANDFILL FOR VADOSE SOIL

This alternative consists primarily of the same components, including offsite incineration of the contents of buried drums and tanks, as contained in Alternative 3, except that contaminated onsite soil within the vadose zone will be overexcavated and placed into a RCRA landfill constructed on site. This alternative provides additional protection over Alternative 3 since it reduces the risk of future leaching of contaminants from the unsaturated materials into the groundwater. The construction and placement of vadose materials in this landfill should greatly reduce the amount of contaminants migrating downward into the groundwater since the cap reduces the infiltration into these materials and the double liner system collects contamination from the unsaturated soils. As the waste being placed in the landfill would be non-decomposing unsaturated soil, leachate production is assumed to be negligible. As with Alternative 3, site fencing, deed restrictions and monitoring will be necessary since contaminants remain on site. Remedial goals for all operable units are addressed.

#### ALTERNATIVE 5 - THERMAL TREATMENT OF "HOT SPOT" SOIL

This alternative consists of similar components as Alternative 3, with the additional excavation and onsite thermal treatment of approximately 27,000 cu. yds. of highly contaminated soil from the southern portion of the site. The drum and tank contents would be treated on site in the mobile incineration unit. One incineration unit would be employed at the site and the duration of treatment would be approximately 5 years. Treatment residue from the onsite incinerator would be replaced in an onsite RCRA landfill. This alternative would greatly reduce known existing onsite sources of contamination and reduces the volume and toxicity of contaminated soil more than either Alternatives 3 or 4. Risks associated with contact with soil contaminants would be reduced by the installation of the multi-layer cap. The removal of drums and the treatment of the most highly contaminated soil would reduce the potential for contaminant release or leaching to groundwater. The installation of a double liner system would collect any contaminant release or leachate to groundwater.

#### ALTERNATIVE 6 - THERMAL TREATMENT OF VADOSE SOIL

This alternative includes components similar to Alternative 5, except that instead of treating only "hot spot" soil, all vadose soil determined to be contaminated, based on RI soil boring data, would be excavated and incinerated. A total of approximately 105,000 cu. yds. of soil would be excavated, incinerated onsite, and backfilled in the same manner as described in Alternative 5. Two incineration units would be employed on site and the duration of treatment would be approximately nine years. This alternative addresses remedial goals for all operable units. Greater protection of public health and environment would be achieved at completion of this action than that achieved by Alternative 5 since a greater amount of contaminants would be destroyed.

#### ALTERNATIVE 7 - THERMAL TREATMENT OF ALL UNCONSOLIDATED MATERIAL TO BEDROCK

In this alternative, all contaminated, unconsolidated material, including buried tanks and drums, all contaminated vadose soil, and all saturated unconsolidated material associated with the contaminated portion of the Water Table Aquifer would be excavated and treated. Excavation would be performed in stages using conventional earthmoving equipment such as draglines and bulldozers. Material excavated from below the water level would be allowed to dewater on drying beds prior to being thermally treated on site. These materials will require dewatering since greater than 75% of the materials will be obtained from below onsite groundwater level. In addition, seepage into the open excavation (estimated to be 6,000 gallons per day) would have to be pumped and treated.

Contaminated soil and other unconsolidated material amounting to approximately 430,000 cu. yds., would be treated on site using the thermal treatment system described in Alternative 5. Treatment of this material would require an estimated 12 years.

As described in Alternatives 5 and 6, drummed and tanked wastes will be excavated and treated in the onsite thermal treatment unit.

Since this alternative would require excavation to bedrock, pipe and media drains would be used for dewatering of the Water Table Aquifer on site. These drains would be constructed during placement of the backfill, thus eliminating the need for shoring of the trench walls during

construction. A trench around the site perimeter and trenches inside the perimeter on 100 ft. centers would be required. Free product collection would be performed during the excavation phase. Analysis of groundwater removed via the drains would be performed to determine whether this water requires treatment. Treatment will be as described for prior alternatives.

#### ALTERNATIVE 8 - IN SITU VITRIFICATION OF "HOT SPOT" SOILS

This alternative parallels Alternative 5 with the major difference being that in situ vitrification of the "hot spot" soils are used as the soil treatment method, rather than onsite incineration. The onsite RCRA landfill would also be eliminated as the soils are vitrified in place. Buried drum and tank contents would be transported off site for thermal treatment. This alternative addresses the remedial goals for all operable units. Similar protection of public health and the environment would be provided at completion of this action, when compared to Alternative 5. An additional benefit would be the encapsulation of inorganic contaminants in the vitrified mass, thereby reducing their mobility.

#### ALTERNATIVE 9 - IN SITU VITRIFICATION OF VADOSE SOILS

This alternative parallels Alternative 6 with the major difference being that in situ vitrification of the vadose soils are used as the soil treatment method, rather than onsite incineration. The onsite RCRA landfill would also be eliminated as the soils are vitrified in place. Buried drum and tank contents would be transported off site for thermal treatment. Rather than a multi-layer cap, the site will be covered with a simple soil cover at the completion of vitrification. This alternative addresses the remedial goals for all operable units. Similar protection of public health and the environment would be provided at completion of this action, when compared to Alternative 6. An additional benefit would be the encapsulation of inorganic contaminants in the vitrified mass, thereby reducing their mobility.

#### SUMMARY OF DETAILED ANALYSIS OF ALTERNATIVES

A summary of the detailed analysis of alternatives is presented in Figure E-4. The range of alternatives provides differing degrees of effectiveness and implementability at various costs. The No Action alternative offers no protection of public health and the

	ASSEMBLED ALTERNATIVE		ASSEMBLED ALTERNATIVE		ASSEMBLED ALTERNATIVE		ASSEMBLED ALTERNATIVE		ASSEMBLED ALTERNATIVE		ASSEMBLED ALTERNATIVE		ASSEMBLED ALTERNATIVE		ASSEMBLED ALTERNATIVE				
	1		2		3		4		5		6		7		8				
EFFECTIVENESS CRITERIA																			
Protectiveness	-	-	Since no remedial actions are being implemented at the site, the risks identified for exposure to soils and groundwater under current and future conditions would remain in excess of 10 <sup>-6</sup> . The volume and migration of contaminants identified remains the same.	0	Provides a minimum of protection to public health and environment. Mostly benefits Watson residence. Reliability lessens over the long term as disrepair of site fence occurs. Does not attain ARARs since site conditions not altered. The volume and migration potential of contaminants identified remains the same.	+	Potential for direct contact with site contaminants is reduced with installation of cap. Removal of drums and offsite incineration provides greater protection from future releases. Both capping and incineration have demonstrated reliabilities and can be designed to meet ARARs. The drum incineration provides a reduction in volume and the cap provides a reduction in mobility.	+	Provides good protection with cap and enclosure of vadose soils in onsite RCRA landfill. Technologies used have proven reliability for prevention of exposure by contact, inhalation, or ingestion. Can be designed to meet ARARs. Reduction in volume accomplished by offsite drum incineration. Provides an additional reduction of mobility by enclosing vadose soils in RCRA landfill.	+	Onsite thermal treatment of "hot spot" soils provides additional short and long term protection. Thermal destruction of organics in treated soil fraction is complete and onsite incineration eliminates need for transport of drums off site. Incineration is a proven reliable technology. ARARs can be met. An additional reduction in TMV is accomplished with thermal destruction of drums and "hot spot" soils. Provides additional reduction of mobility by enclosing treated soil in onsite RCRA landfill.	+	Same as Alternative 5 except with additional volume of soil being treated. This provides greater reduction in volume. Encapsulation of all vadose soils in RCRA landfill decreases mobility of inorganic contaminants remaining in treated soil.	+	Same as Alternative 6 with exception being additional volume of soil being treated. Provides additional reduction in volume over Alternative 6.	+	In situ vitrification (ISV) of "hot spot" soils provides additional short and long term protection. Destruction of organics in treated soil fraction is complete, and TMV is improved by immobilization of inorganics. Offsite transport and incineration of drums is required. ISV is an innovative technology and has not yet been fully demonstrated on a large-scale basis. ARARs can be met.	+	Same as Alternative 8, with additional reduction in TMV achieved by treatment of larger soil volume.
Reliability	-	-		0		+		+		++		++		++		++			
ARARs	-	-		-		+		+		+		+		+		+			
Reduction in toxicity, mobility, or volume (TMV)	--	--		--		0		+		+		+		++		+			
IMPLEMENTABILITY CRITERIA																			
Technical Feasibility	NA	NA	Providing No Action at the site will probably result in public concern over unmitigated health hazards.	+	House moving and environmental monitoring are both feasible and available. Public concerns still likely since only Watson residence being addressed.	+	Drum extraction may be difficult due to random drum orientation and health and safety procedures required to be implemented. All technologies readily available. Community concerns may be reduced due to idea of site remediation, but concern may arise with drum transport off site.	+	Involves double handling of material, but is still feasible. Technology uses standard construction methodologies and are readily available. Same public concern may occur with transport of drums, but probably a better overall view of remediation due to additional enclosure of contaminants in RCRA landfill.	+	Results in handling of ash as hazardous material, but should be of less volume than double handling of soils placed into onsite RCRA landfill as in Alternative 4. Availability of incinerator for 5 years is questionable. Public concern over onsite incineration may be significant. Better overall view of remediation due to enclosure of contaminants in RCRA landfill.	+	Same as Alternative 5, with a greater concern relative to incinerator availability, requiring two units for approximately 9 years.	-	Same as Alternative 6, with a greater concern relative to incinerator availability, requiring two units for approximately 12 years.	+	Appears to be technically feasible. Not yet available from multiple sources, therefore availability is a concern. May be some public concern over offsite transport of drums, but overall public perception of this alternative should be reasonable.	+	Same as Alternative 8.
Availability	NA	NA		+		++		++		0		-		--		-			
Administrative Feasibility	--	--		-		0		+		+		0		-		+			
ORDER OF MAGNITUDE <sup>a</sup> COST ESTIMATES																			
Total Capital <sup>b</sup>			\$0		\$150,000		\$11,000,000		\$18,000,000		\$13,000,000		\$21,000,000		\$43,000,000		\$15,000,000		\$12,000,000
Present Worth <sup>c</sup>			\$0		\$820,000		\$15,000,000		\$22,000,000		\$24,000,000		\$46,000,000		\$127,000,000		\$27,000,000		\$39,000,000

#### NOTES:

<sup>a</sup> The American Association of Cost Engineers defines an Order-of-Magnitude Estimate as an approximate estimate made without detailed engineering data. It is normally expected that an estimate of this type is accurate within +50% to -30%. Sources of cost information include the U.S. EPA's "Compendium of Cost of Remedial Technologies at Hazardous Waste Sites," the Means Site Work Cost Data guide, Cost Reference Guide for Construction Equipment and vendor estimates.

<sup>b</sup> Total Capital Cost includes indirect cost for engineering services, legal fees, administration costs and cost contingencies. Refer to Tables 6-3 through 6-10 for a summary of the cost estimate for each alternative.

<sup>c</sup> Total Present Worth Cost is based on 30-year period and 10 percent interest.

#### LEGEND:

- EXTREMELY NEGATIVE EFFECTS; EVEN WITH MITIGATING MEASURES CAPABLE OF ELIMINATING AN ALTERNATIVE
- NEGATIVE EFFECTS BUT NOT STRONG ENOUGH TO BE THE SOLE JUSTIFICATION FOR ELIMINATING AN ALTERNATIVE OR OF ONLY MODERATE SIGNIFICANCE
- 0 OF VERY LITTLE APPARENT POSITIVE OR NEGATIVE EFFECTS, BUT INCLUSION CAN BE JUSTIFIED FOR SOME SPECIAL REASON OR NO CHANGE FROM EXISTING CONDITIONS
- + A POSITIVE OR MODERATELY POSITIVE BENEFIT |- ++ AN EXTREMELY POSITIVE BENEFIT
- \* ANALYSIS NOT COMPLETE OR INAPPROPRIATE TO DRAW CONCLUSIONS AT THIS TIME
- NA NOT APPLICABLE

FIGURE E-4  
SUMMARY OF DETAILED  
ANALYSIS OF ALTERNATIVES  
SUMMIT NATIONAL FS

environment, nor reduction of toxicity, mobility or volume (TMV) of contaminants. Alternative 2 provides minimal protection by mitigating the existing health risks to the Watson family. Alternative 2 relies heavily on monitoring for protection of public health and, like Alternative 1, does not reduce TMV. The only positive aspects of Alternative 2 are its low cost and its reliance on readily available and technically feasible technologies.

Alternatives 3 through 9 incorporate containment and treatment of contaminated groundwater. The vertical barrier and pumping of the Water Table Aquifer would reduce contamination in that aquifer and also stagnate the contaminant plume in the Upper Intermediate Unit. Additional protectiveness and reliability is provided by extraction of contaminated groundwater from the Upper Intermediate Unit. As contamination from the Upper Intermediate Unit is removed, it may eventually lead to aquifer restoration and cessation of pumping.

The removal and incineration of subsurface waste (buried drums and tanks) in Alternatives 3 through 9 eliminates a major known existing onsite contaminant source. This provides a significant reduction in TMV and increased protection of public health and the environment by preventing future releases. The subsurface waste will be destroyed, thus complying with the intent of SARA.

The largest variation in alternatives is in dealing with contaminated soil and sediment. Alternatives 3 and 4 provide containment of contaminated soil and sediment. The containment provided in Alternative 4 is more reliable as it incorporates a double liner system to prevent leachate migration, while Alternative 3 only offers a multi-layer cap to reduce infiltration. However, Alternative 4 is more costly and requires excavation and placement of untreated material in a landfill which does not fully satisfy the intent of SARA.

Alternatives 5 through 9 include soil treatment. The greatest reduction in TMV is achieved in Alternative 7, followed by Alternatives 6 and 9, then Alternatives 5 and 8. Alternatives 5, 6 and 7 are more reliable than Alternatives 8 and 9 as they utilize incineration, which is a well demonstrated technology. Alternatives 8 and 9 provide the additional benefit of encapsulating inorganic contaminants, although they are not contaminants of major concern at this site. The proposed in situ vitrification for soil treatment is not in common use; thus,

uncertainties in performance are inherent. Of the soil treatment alternatives, Alternative 5 is most economical and reliable.

#### PREFERRED ASSEMBLED ALTERNATIVE

In assessing alternatives for remedial action, the preferred alternative for Summit National Site is Alternative 5. This alternative provides adequate protection to public health and environment and significantly reduces the volume, toxicity, and mobility of contaminants. This alternative utilizes treatment technologies, permanent solutions to the maximum extent practicable, and is cost-effective.

#### DESCRIPTION OF THE PREFERRED ALTERNATIVE

This alternative includes access/deed restrictions, runoff monitoring, groundwater monitoring, removal of onsite structures, excavation and incineration of drums and tanks, "Hot Spot" soils and sediments, multi-layer cap, vertical barrier and groundwater extraction wells, elimination of onsite surface water, water treatment, and relocation of the Watson residence.

This alternative will remove a major source of contamination which includes the removal of approximately 1600 buried drums and four tanks. These wastes will be incinerated on site using a mobile incinerator. Another major source of contamination is the "hot spot" soils which will also be incinerated on site. The risk associated with soils will be greatly reduced. This alternative will take about five years to achieve.

The groundwater cleanup will consist of treating groundwater from the Water Table Aquifer, Upper Intermediate Unit, and surface water. The cleanup goal is to meet water quality standards. In the absence of ARARs, the cleanup goal is the attainment of a  $10^{-6}$  carcinogenic risk level for site contaminants. The time required for groundwater cleanup of the Intermediate Unit is estimated to be about 5 to 10 years while the cleanup of the Water Table Aquifer will be more than 30 years.

This alternative provides containment of treated wastes and soils which protects public health and the environment from any type of residual contaminant migration. The untreated soils have an upperbound lifetime cancer risk of  $3 \times 10^{-5}$  can only occur if the cap fails and exposure to the sub-surface materials becomes a complete exposure pathway. The



option includes onsite RCRA landfill, multi-layer cap, and vertical barriers. Runoff and groundwater monitoring will evaluate the efficiency of the containment and will indicate if any further action is warranted.

This alternative complies with applicable or relevant, and appropriate Federal and State requirements identified for the site. Technical implementability can be achieved without difficulty since equipment necessary is generally available including the mobile incinerators. This alternative has a capital cost of \$13,000,000 and an annual operation and total Present Worth Cost including O&M is about \$24,000,000.

In conclusion, Alternative 5 is recommended as the preferred alternative for remedial action at the Summit National Site in Deerfield, Ohio.

## CHAPTER 1

### INTRODUCTION

The Summit National Site is in Deerfield Township, Portage County, Ohio. It was determined by the United States Environmental Protection Agency (U.S. EPA) and the Ohio Environmental Protection Agency (OHIO EPA) that the site potentially contained hazardous wastes resulting from improper past disposal practices. Because of the possibility of human and environmental exposure to potentially contaminated surface water, sediment, and surface soils, as well as the potential for migration of the hazardous materials from the site by potentially contaminated surface water, sediment, and surface soils, as well as the potential for migration of the hazardous materials from the site to a drinking water aquifer and surface water, the site was included by U.S. EPA on the National Priorities List of uncontrolled hazardous waste sites under the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA). The authority to list, investigate, and remediate hazardous waste sites under CERCLA has been extended and amended by the Superfund Amendments and Reauthorization Act of 1986 (SARA).

CERCLA and now SARA give U.S. EPA the authority to respond to actual or potential release of hazardous substances that pose an imminent and substantial threat to human health, welfare, or the environment. Pursuant to Section 105 of CERCLA, U.S. EPA promulgated revisions to the National Oil and Hazardous Substances Contingency Plan (NCP) - latest revisions effective February 18, 1986, to effectuate the response powers and responsibilities created by CERCLA. Subpart F of the NCP, Hazardous Substance Response, establishes methods and criteria for determining the appropriate extent of response authorized by CERCLA and outlines a procedure for determining the nature and extent of contamination at a site and the appropriate extent of remedy for the site.

Based upon the NCP, the U.S. EPA has developed a program of emergency response, remedial response, and enforcement to implement CERCLA and SARA. As part of this program, U.S. EPA's Hazardous Site Control Division (HSCD), employs contractors to conduct remedial planning activities (Remedial Investigations

and Feasibility Studies, RI/FS). The RI/FS at the Summit National Site began in February 1984 with the issuance by U.S. EPA of Work Assignment No. WA 57-5L04 to CH2M Hill.

### 1.1 PURPOSE

The purpose of this Feasibility Study (FS) report is to summarize the process used to develop and evaluate remedial action alternatives for the Summit National Site. In accordance with the NCP, the appropriate extent of remedy is defined as a "cost-effective remedial alternative that effectively mitigates and minimizes threats to and provides adequate protection of public health and welfare and the environment" [40 CFR 300.68(i)]. This FS is based on the information and data presented in the Final RI Report issued by EPA on February 1, 1988.

The methodology used in this FS report allows a step-by-step evaluation of technologies, alternatives, and assembled alternatives by progressing through a series of screenings (see Figure 1-1). Initially, general qualitative information is used. Subsequently, more refined and quantitative information is used to eliminate from consideration infeasible or otherwise unacceptable actions. This methodology provides a systematic procedure for identifying and evaluating alternatives, specifying criteria for determining the magnitude and importance of effects resulting from the implementation of an action, and considering measures to mitigate adverse effects.

### 1.2 SITE DESCRIPTION

The Summit National Site is located in Deerfield Township, Portage County, Ohio, approximately 45 miles southeast of Cleveland and 20 miles west of Youngstown (Figure 1-2).

The Summit National Site is approximately rectangular in shape and occupies approximately 11.5 acres at the southeast corner of the intersection of Ohio Route 225 to the west and U. S. Route 224 to the north (Figure 1-3).

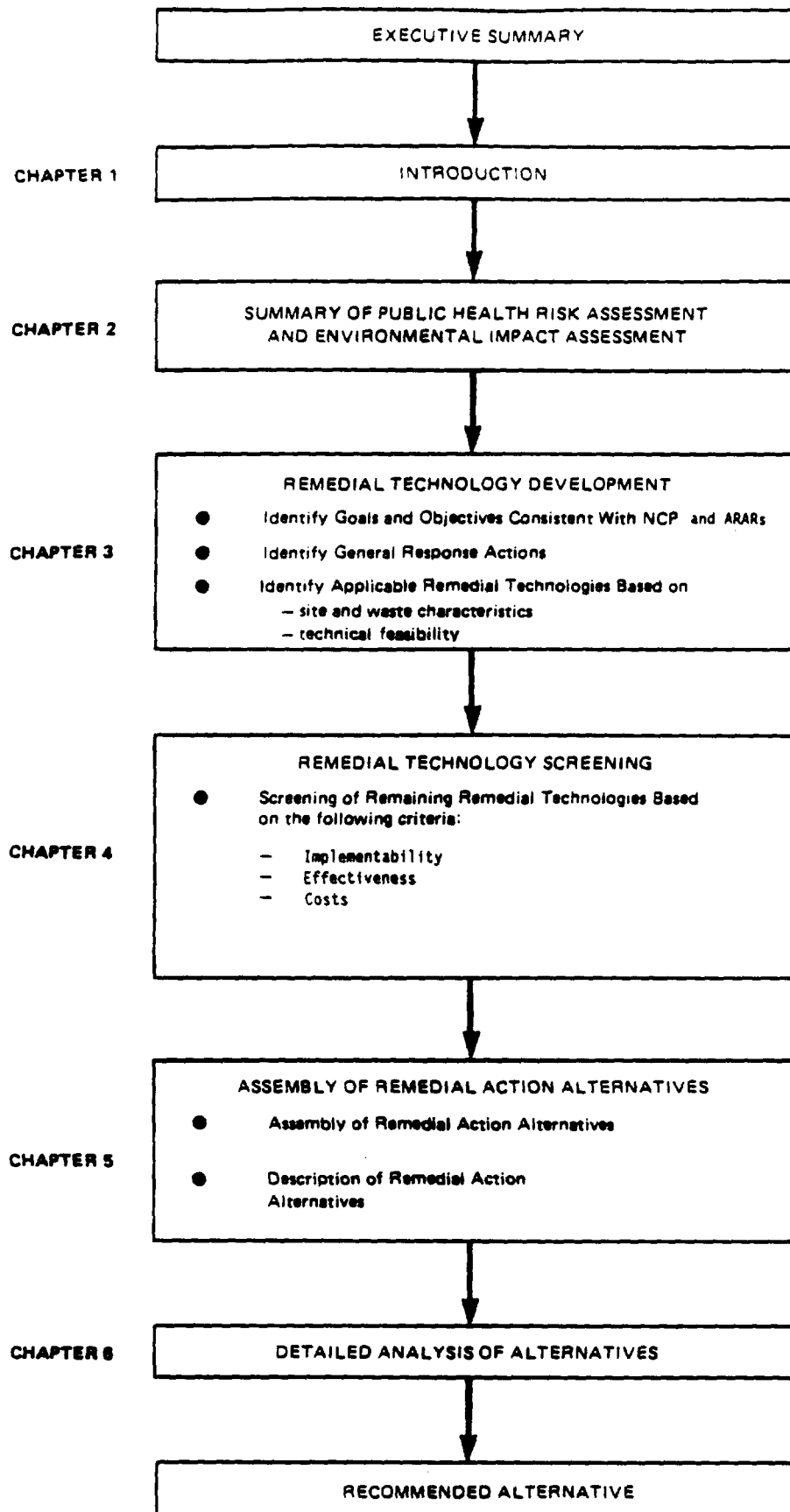


FIGURE 1-1  
FLOW DIAGRAM FOR  
SUMMIT NATIONAL FS  
SUMMIT NATIONAL FS

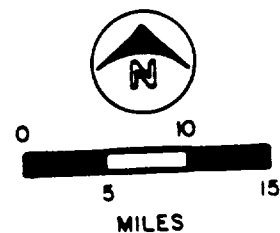
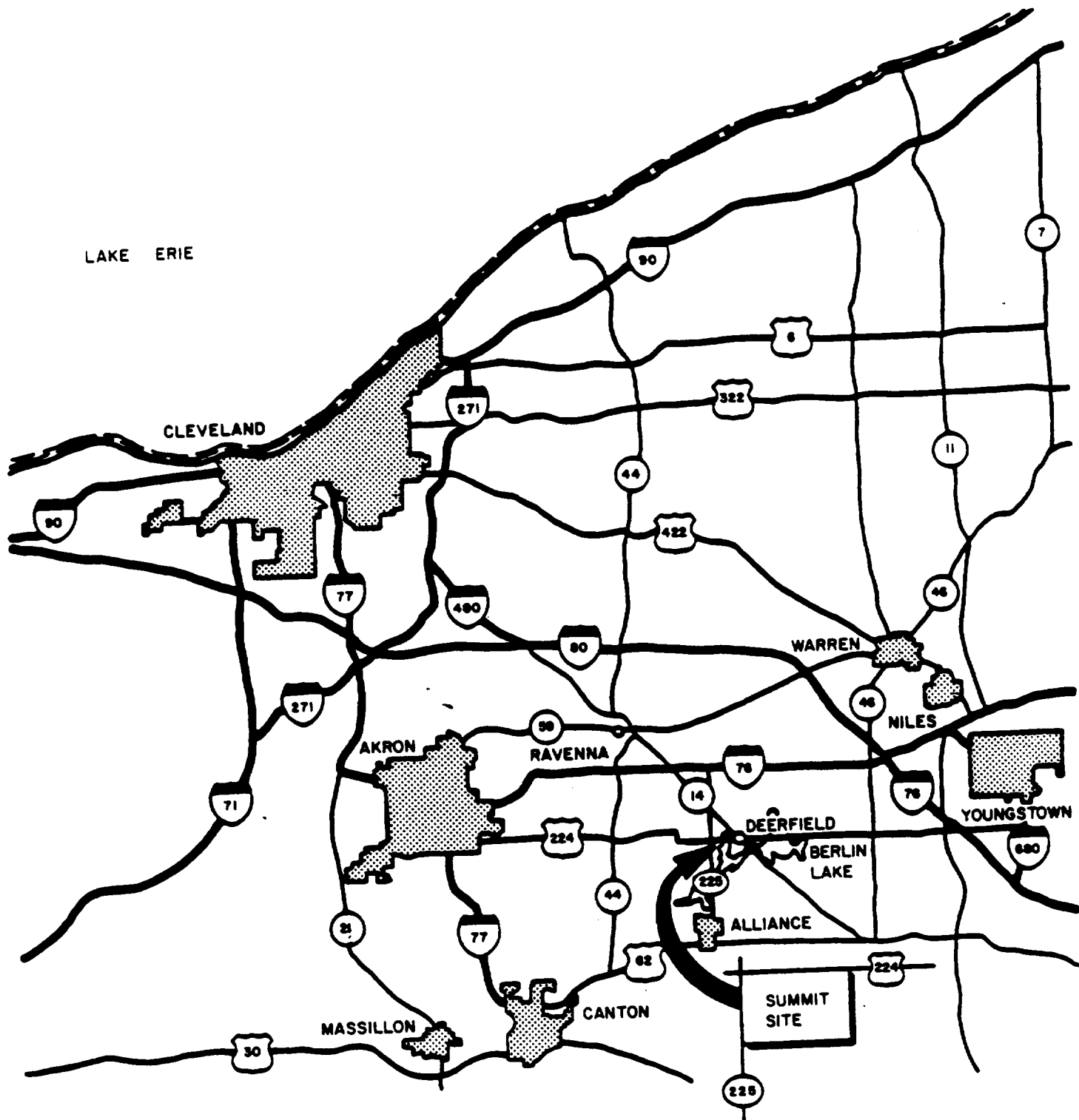
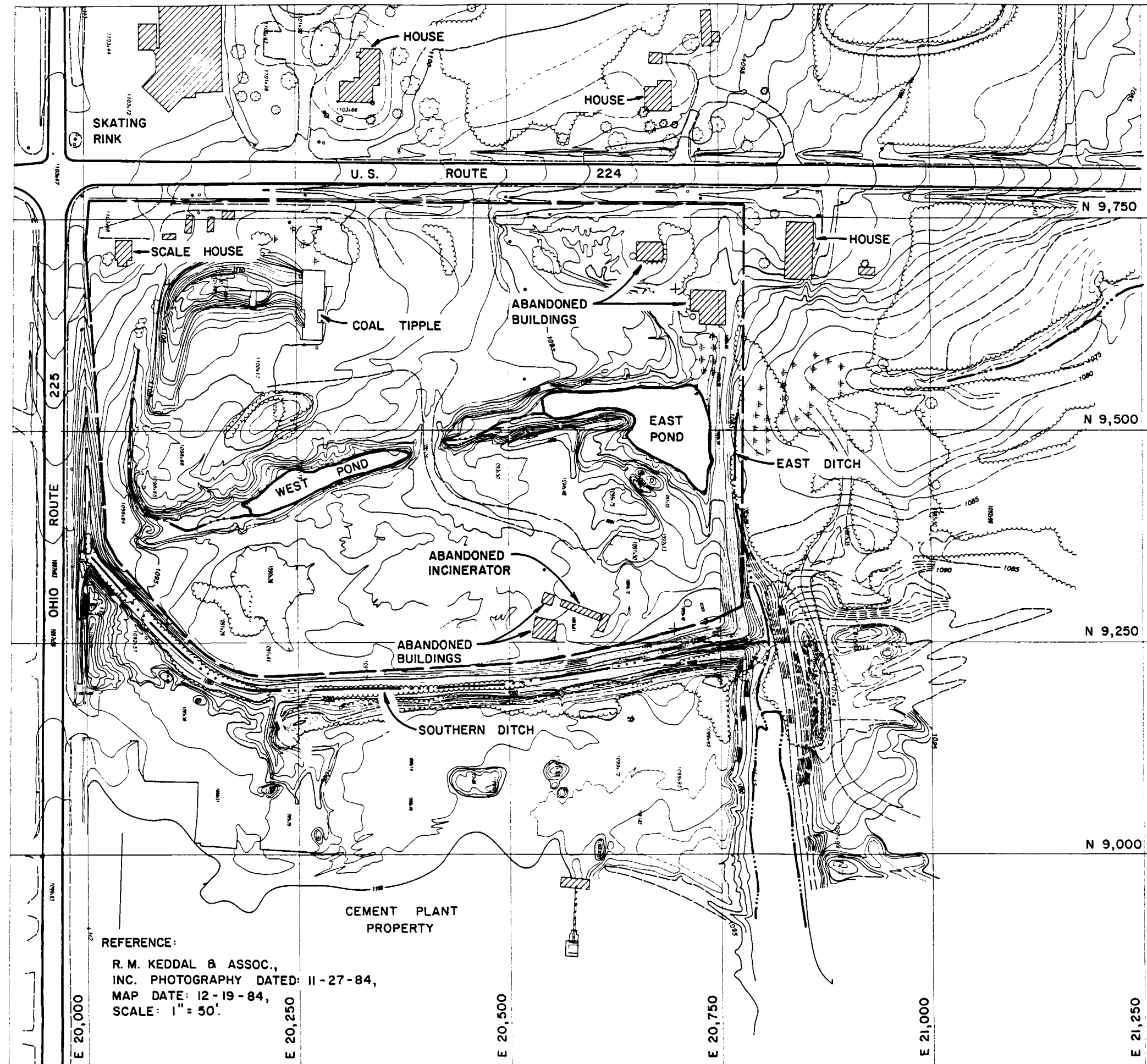


FIGURE 1-2  
SUMMIT SITE LOCATION  
SUMMIT NATIONAL FS



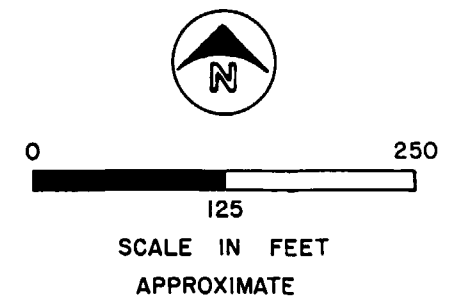
LEGEND

--- EXISTING FENCELINE

- . - . - DITCH

≡ ≡ ≡ MARSHY AREA

ALL ELEVATIONS IN FEET (MSL)



REFERENCE:

R. M. KEDDAL & ASSOC.,  
INC. PHOTOGRAPHY DATED: 11-27-84,  
MAP DATE: 12-19-84,  
SCALE: 1" = 50'.

FIGURE 1-3  
SITE TOPOGRAPHIC MAP  
SUMMIT NATIONAL FS

The site was a coal strip mine and contained a coal wash pond and coal stock pile prior to its use as an incinerator site. The coal tipple remains as a 15 ft. high embankment in the northwest corner of the site with a loading dock and concrete debris remaining from the original coal processing facilities. Other prominent features on site are two ponds located in the midsection of the site, an abandoned incinerator and two buildings in the southeast corner, a scale house in the northwest corner, and two dilapidated buildings in the northeast corner. Additionally, it is estimated that approximately 900-1,600 drums and three known tanks and one suspected tank remain buried on site. Little vegetation is growing on site since most of the site was graded following periodic surface cleanup activities which were performed from 1980 through 1982. The site is enclosed by a 6 ft. high fence with two locked gates for entrance from Route 224 and one locked gate for entrance from Route 225.

The area immediately surrounding the site has been developed for a variety of uses, primarily rural residences, light industries and agriculture. Several residences are located to the north, east and west within 500 ft. of the site. A roller skating rink is immediately north of the site. Light industries in the area include a fuel distributor, a cement plant and manufacturer of septic tanks, two sanitary landfills, and used tire storage lots. Unused areas near the site are either wooded or unvegetated strip mined lands.

### 1.3 SITE HISTORY

All information in Section 1.3 pertaining to site history was obtained from and based on the existing Summit National Remedial Action Master Plan (RAMP) (CH2M Hill, August 1983) and the OHIO EPA files available from the Twinsburg, Ohio office.

In June 1973, a "Permit to Install" was obtained for an 18,000 gallon per month waste liquid incinerator at the Summit National site. In April 1974 an operating permit issued by the OHIO EPA was obtained for the incinerator. The facility, called Summit National Liquid Services, received liquid wastes from various manufacturing and chemical companies. The wastes were either delivered in bulk using tanker trucks or in 55 gallon drums on flatbed trucks.

Wastes were stored unprotected in 55 gallon drums, an open pit or bulk tanks of varying size. Many wastes were mixed with flammable liquids and incinerated. Some wastes were buried on site, while others were dumped or leaked onto the site soil. The incinerator reportedly operated until 1978.

During its operating history, a variety of industrial wastes were disposed at the Summit National Site. Drummed and tanked wastes disposed included waste oils, resins, paint sludges, flammable solvents, chlorinated solvents, plating sludges, pesticide wastes, phenols, cyanides, acids, various polymers, and lab packs. Many of the drums and bulk tanks stored on the surface leaked quantities of these materials to the site. It was reported that the concrete block pit was used for liquid waste mixing and solidification and overflowed on a recurring basis during periods of heavy rainfall.

In June 1975 the Northeast District Office of the OHIO EPA investigated a complaint of an unauthorized discharge of waste water from the site. The U.S. EPA conducted an investigation of the site on October 29, 1976 and found evidence of numerous leaks and spills. The owner was notified of the need for a Spill Prevention Control and Countermeasures Plan (SPCC) and informed that he was in violation of state laws relating to treatment and disposal of industrial wastes. The OHIO EPA Director issued Final Findings and Orders on June 12, 1978. These required Summit National to cease receiving waste materials, remove all liquid waste from the site, and receive written approval prior to removing any material from the facility. No further waste material was received after this date.

In August 1979, the State of Ohio filed a complaint against the present and former owners alleging the operation of a solid waste disposal site without a permit, creation of a public nuisance, failure to comply with orders from the Ohio EPA, and installation of facilities for the storage and disposal of liquid wastes without submitting plans to the Ohio EPA. Testing of onsite waste materials established the presence of over 7,500 gallons of a toxic chemical, hexachlorocyclopentadiene, commonly called HCCPD or C-56. In September 1979, U.S. EPA notified the owner that, because C-56 and other hazardous chemicals were leaking to the environment, remedial action was being planned pursuant to Section 311 of the Clean Water Act. The owner refused to take voluntary action or fund the cleanup operation, so U.S. EPA funded the cleanup of C-56 wastes that took place between September and November 1980.



In November 1980, an agreement was reached between the State and eight generators that provided \$2.5 million for surface cleanup. Surface cleanup operations, including removal of drums, tanks and various surface debris and a small amount of contaminated soil, were concluded in June 1982.

#### 1.4 PRIOR REMEDIAL ACTIONS

From early spring to late fall of 1980, OHIO EPA contracted to fence the site, to grade the site to control surface water runoff and runoff and near-surface groundwater flow, to identify and stage about 2,000 drums of wastes, to sample and analyze the contents of several bulk tanks, and to install and develop groundwater monitoring wells (two on site, four off site). During the fall of 1980, U.S. EPA funded the removal of three bulk tanks and their contents (approximately 7,500 gallons), some contaminated soil, and the treatment of contaminated water. In 1980 and 1981, several of the companies that had previously used Summit's services identified themselves and voluntarily removed wastes they had sent to the site for disposal.

A surface waste cleanup was conducted at the site from fall of 1981 through late spring of 1982 by three waste generators and the state. This cleanup included removal and treatment or offsite disposal of all surface drums, bulk tanks, containers, the concrete block pit, and their contents. Some incidental contaminated soil removal was necessary as part of the cleanup operation, but soil removal was not extensive. The 1981-82 surface cleanup project removed much of the source of site contamination, but did not include subsurface exploration or cleanup. During the site cleanup, the OHIO EPA identified several areas potentially containing buried drums and/or tanks.

During the Spring of 1987, U.S. EPA Region V Emergency Response Section was on site responding to an emergency situation related to periodic overflows from the east pond onto the adjacent residential property. Emergency activity included the excavation and disposal of a buried tank located immediately north of the old incinerator which contained hazardous materials. The work was performed in conjunction with the Region V Technical Assistance Team (TAT).

The following work was completed by the TAT:

- The eastern bank of the east pond was regraded and elevated to increase freeboard. A riser pipe was installed in the pond to provide relief flow from the pond prior to the water level cresting and creating an overflow situation.
- Additional soil was placed along the northeastern boundary of the site to prevent runoff.
- The underground tank located near the incinerator was excavated and placed on the site surface for disposal. The contents were stored onsite until further waste characterization was known for proper disposal.

#### 1.5 SITE REMEDIAL INVESTIGATION

Remedial investigation activities performed during the Summit National Remedial Investigation were conducted by the EPA in two separate phases. Phase I remedial investigation activities were conducted during October, November and December, 1984. Phase II remedial investigation activities were conducted in two separate episodes during December 1985 through January 1986, and June 1986 through September 1986. The remedial investigation activities performed by the EPA included:

- Performing an Electromagnetic Conductivity (EM) survey, a Ground Penetrating Radar (GPR) survey, and a magnetometer survey to locate buried drums and tanks.
- Locating, drilling, logging, installing 24 monitoring wells and 12 shallow piezometers and collecting samples from the 24 new wells and 5 existing wells to estimate groundwater conditions.
- Drilling and sampling 47 test borings on site to a depth of about 8 ft. to estimate the vertical extent of onsite soil contamination.
- Collecting onsite surface soil samples to estimate the horizontal extent of onsite soil contamination.

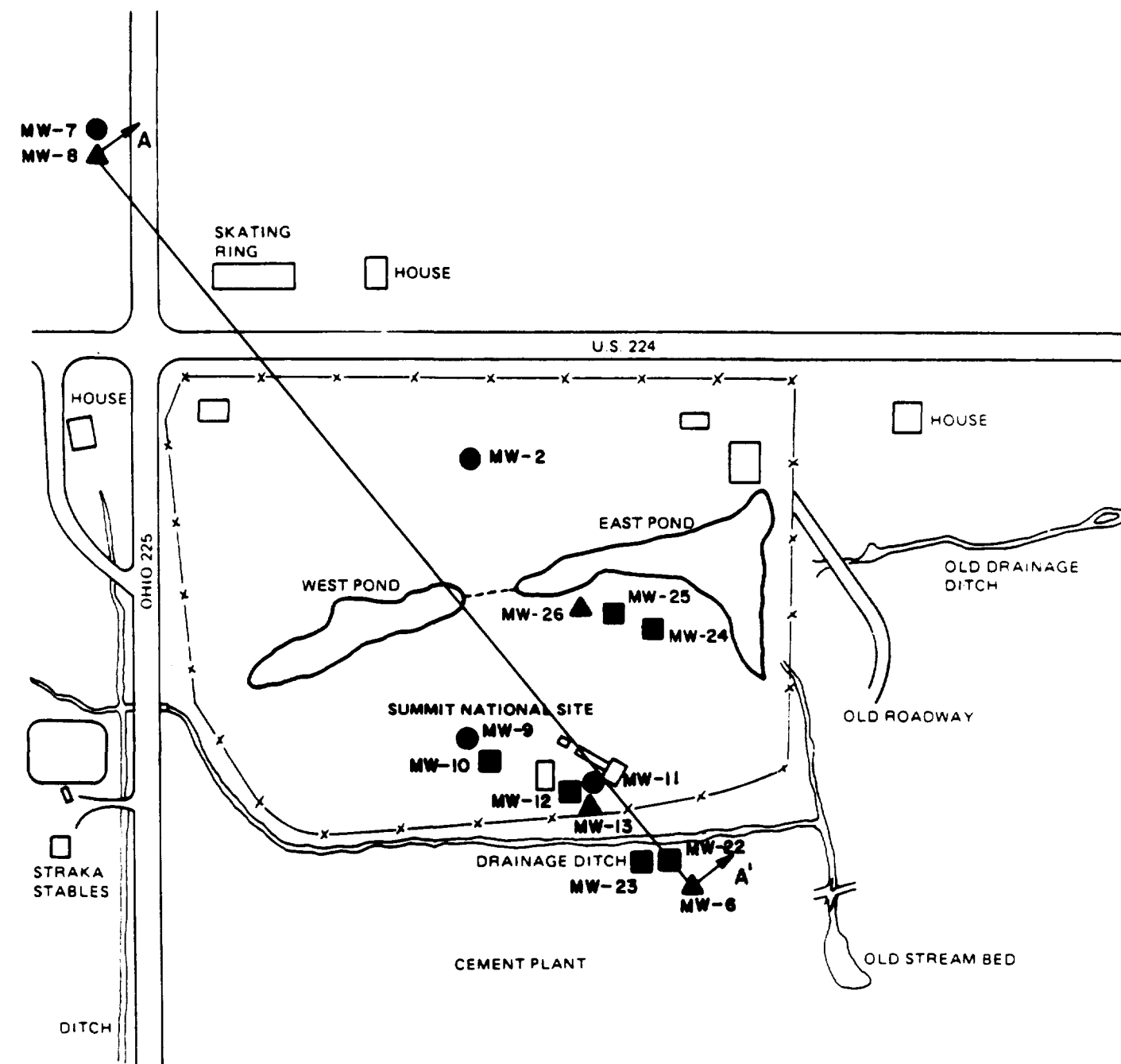
- Collecting offsite perimeter soil samples.
- Collecting background soil samples.
- Excavating 13 test pits to search for buried drums, to estimate their number and condition, and to sample their contents.
- Collecting onsite and offsite surface water and sediment samples.
- Collecting air samples for the purpose of identifying potential respiratory hazards prior to the commencement of site investigation activities.
- Performing a structures survey to document the condition of site structures.
- Collecting residential well samples.

The following subsections summarize the results of the RI.

#### 1.5.1 Geology and Hydrogeology

Surficial Geology: Surficial deposits at the Summit National Site include glacial till, fill, and mine spoil. Cross-sections presenting the geologic results of the RI are shown on Figures 1-4b and 1-5b, while the locations of each section line are shown on Figures 1-4a and 1-5a, respectively. The till is a mixture of unstratified silt, sand, and clay, with some rock fragments. The fill and mine spoil tend to occur together on site. Mine spoil is the rock and soil refuse generated by strip mining. The fill is comprised of a variety of man-placed materials, apparently including disturbed till, crushed rock, and miscellaneous refuse. These deposits are prevalent on the southern portion of the site and in offsite areas south of the site. A thin layer of fill and mine spoil is also present over the till on the northern portion of the site, apparently placed during grading for initial remediation of the site performed during 1981 and 1982.

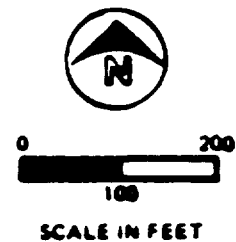
Bedrock Geology: Bedrock beneath the site is the Pennsylvanian-age Pottsville Formation, which is comprised of sandstones, shales, siltstones, coals, and limestones (Figure 1-6). Two members of this



#### LEGEND

- MONITORING WELL IN WATER-TABLE AQUIFER
- MONITORING WELL IN INTERMEDIATE ZONE
- ▲ MONITORING WELL IN UPPER SHARON AQUIFER

A — A' LINE OF PROFILE



NOTE: All locations of structures and physical features are approximate.

SOURCE: Modified from USEPA.

FIGURE 1-4a  
SECTION LINE A-A'  
SUMMIT NATIONAL FS

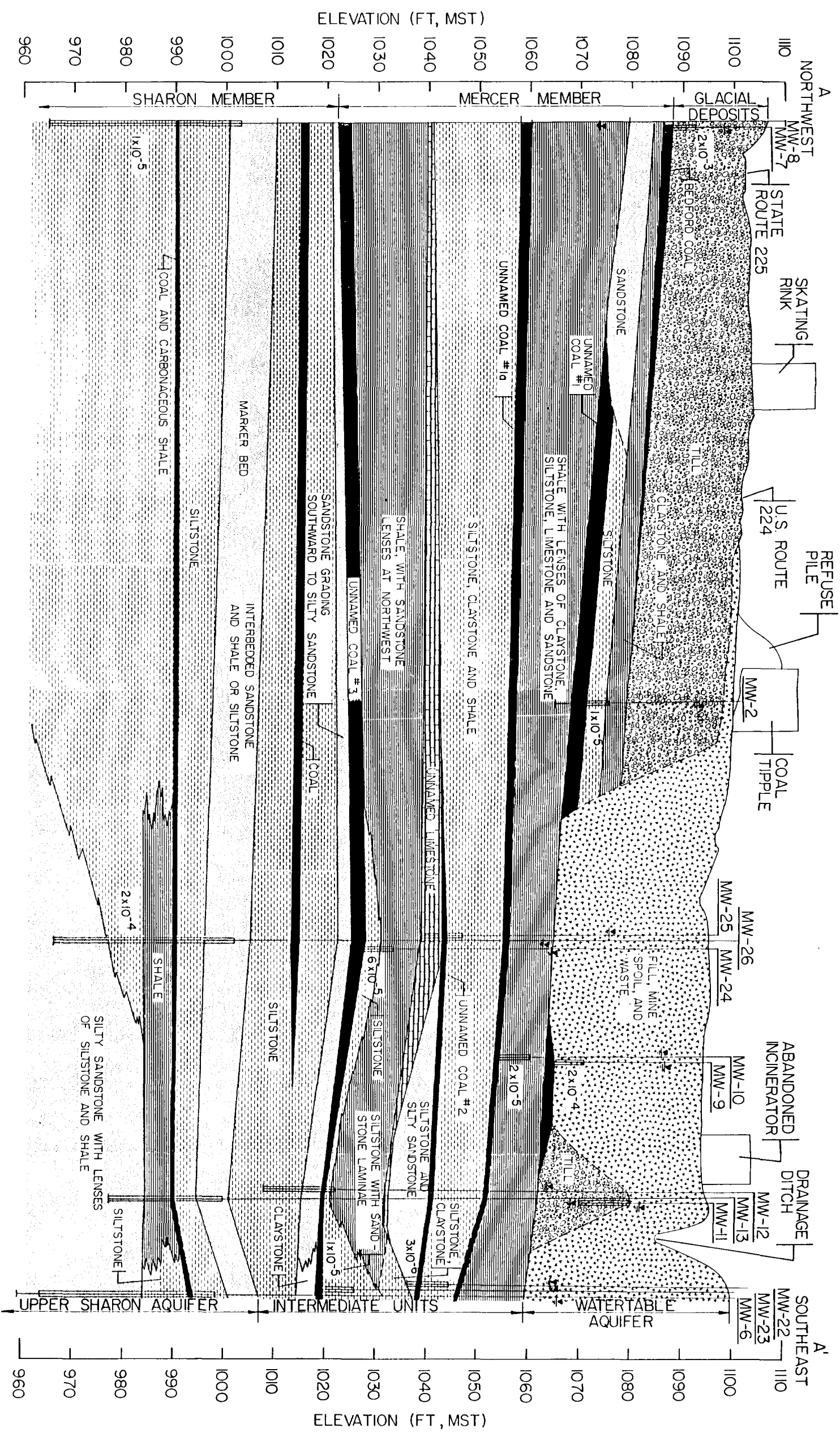
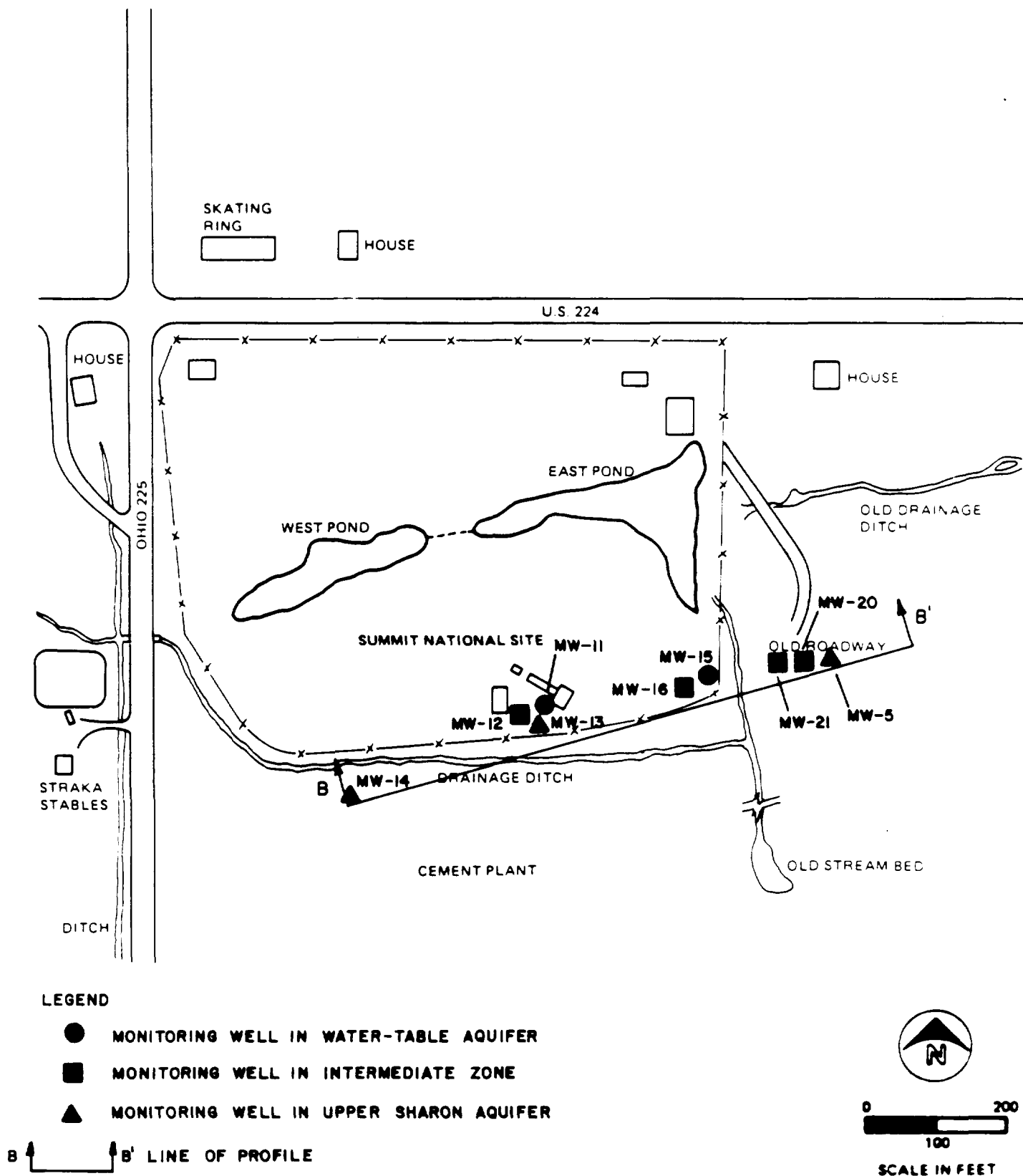


FIGURE 1 - 4b  
GEOLOGIC SECTION A-A  
SUMMIT NATIONAL FS



NOTE: All locations of structures and physical features are approximate.

SOURCE: Modified from USEPA.

FIGURE 1-5a  
SECTION LINE B-B'  
SUMMIT NATIONAL FS

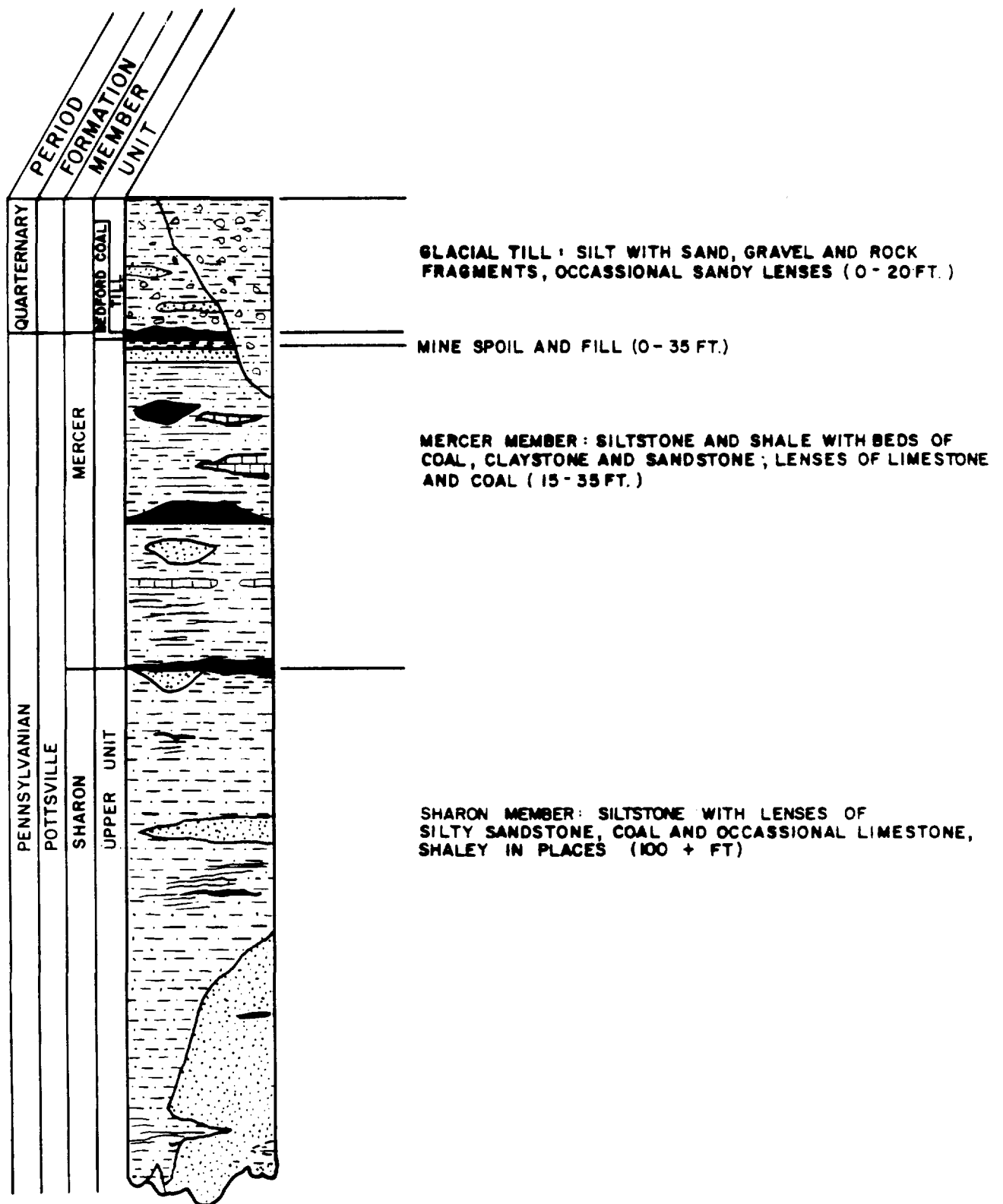
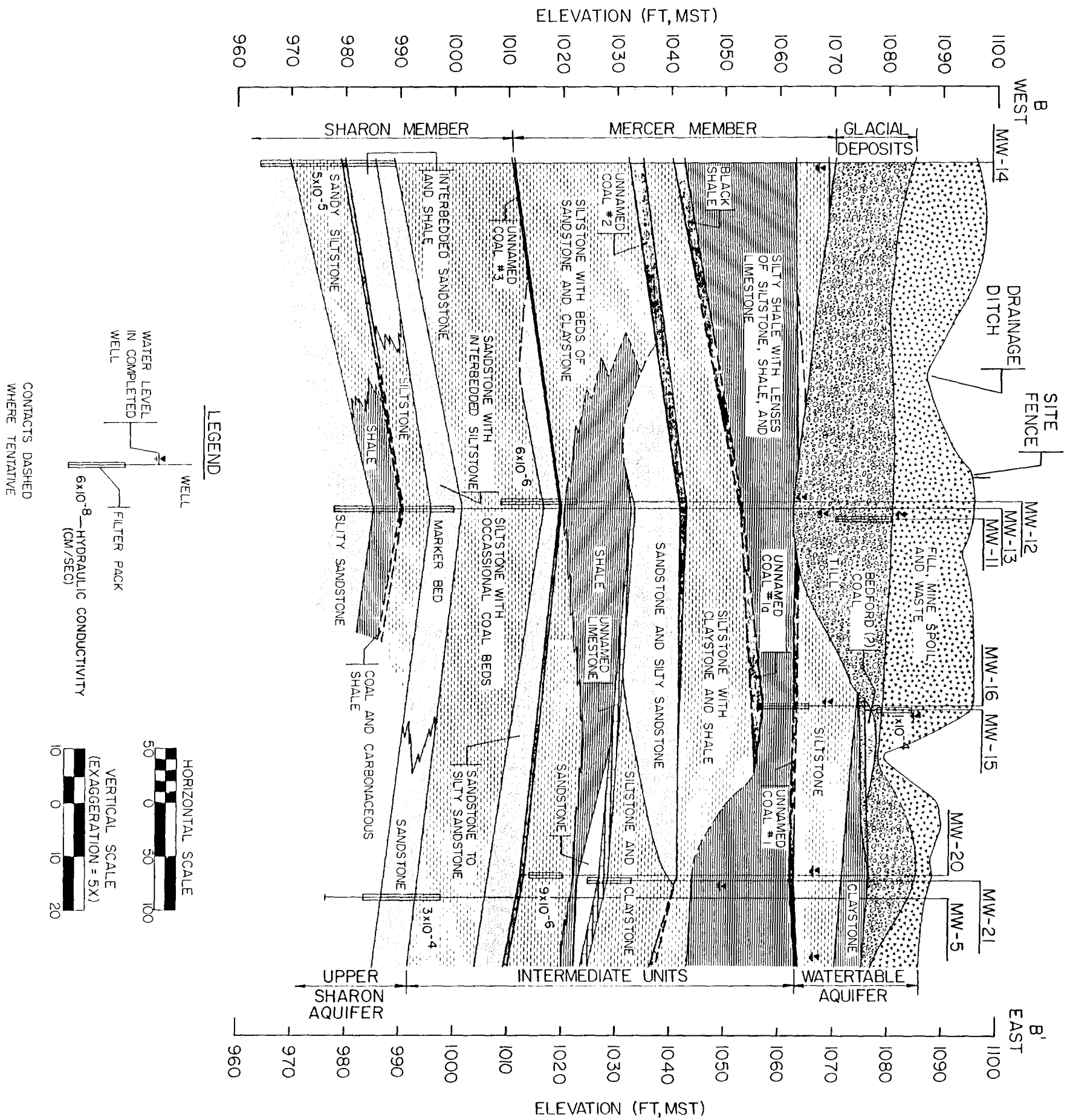


FIGURE 1-6  
GENERALIZED STRATIGRAPHIC COLUMN  
SUMMIT NATIONAL FS





formation were encountered during the RI: the upper unit of the Sharon Member and the overlying Mercer Member. Normally, the Connoquenessing Sandstone separates these two units, but it is apparently absent beneath the site (Winslow and White, 1966). The Sharon Member consists of a lower conglomeratic unit and an upper fine-grained ("shale") unit. The "shale" unit of the Sharon Member was found to be a series of siltstones, silty sandstones, and sandstones, with some shale, coal, and limestone (Figures 1-4b and 1-5b). The shales and limestone are apparently discontinuous; the coals vary in lateral extent.

When present, the Connoquenessing Sandstone consists of a massive, coarse- to medium-grained, light-colored sandstone. Regionally, this unit can be up to 140 feet thick (Sedam, 1973), and may have a central shaley unit. This unit occurs throughout most of the area, and probably exists in the area immediately surrounding the site (Winslow and White, 1966; Pinzon, 1986). Beneath the site, the Sharon Member is unconformably overlain by the Mercer Member, which consists primarily of silty to carbonaceous shales with coals, underclays, limestones, and sandstones. The bedrock surface is often developed on the Bedford Coal.

Regional Hydrogeology: Two regional water-supply aquifers are present in the vicinity of the Summit National Site - the Connoquenessing Sandstone and the lower conglomeratic unit of the Sharon Member. The Sharon Member is not often exploited in the vicinity of the site because sufficient yield can generally be obtained from the shallower strata. The Connoquenessing, because of its shallower depth, is more heavily exploited than the Sharon, particularly for private wells. As discussed earlier, this unit is absent beneath the site, but apparently occurs in the area immediately around the site.

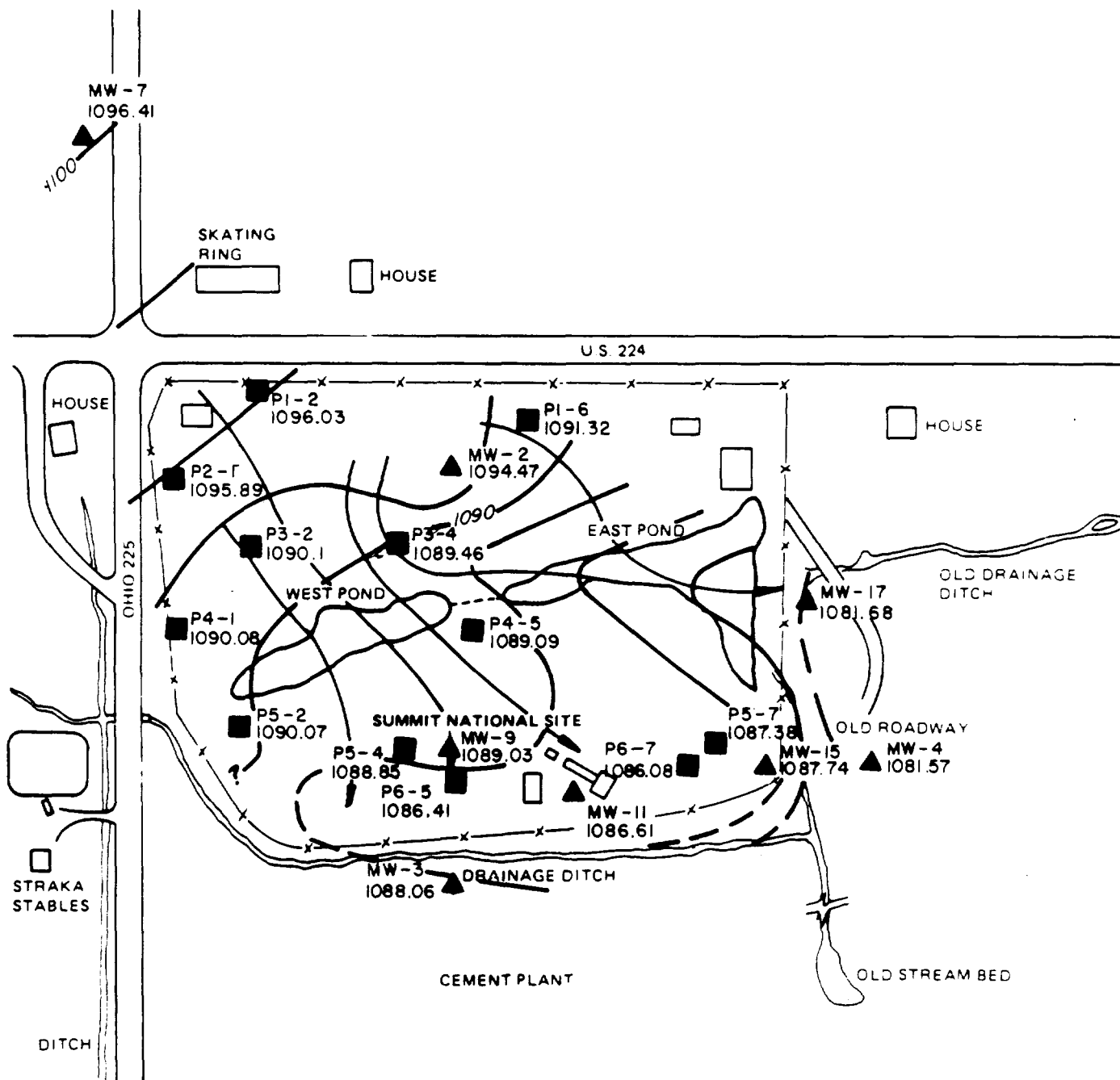
There are over 50 private wells within two miles of the Summit National Site used for water supply for both domestic and industrial purposes. Available well logs from OHIO EPA (via Pinzon, 1986) indicate that many domestic wells are completed in units not considered to be regional aquifers, including the Mercer member and the upper unit of the Sharon Member. Data contained in the RI indicated that, of 36 logged wells within two miles of the site, 10 draw all or part of their water from the Connoquenessing Sandstone, 3 draw from the lower unit of the Sharon Member, and 23 draw water from units not identified as

regional aquifers. Of the 23, 20 are screened in the intermediate units corresponding to the Mercer Member and three draw water from the shale of the Sharon Member.

Site Hydrogeology: The strata beneath the Summit National Site has been divided into three groups: the water-table aquifer, a group of "intermediate units," and an Upper Sharon "aquifer." The water-table aquifer occurs in the fill, till, mine spoil, and shallow bedrock, apparently extending to the base of Unnamed Coal #1 (Figures 1-4b and 1-5b). The intermediate units are the predominantly fine-grained strata between the base of the water-table aquifer and the top of the sandstone marker bed. The intermediate units correspond to the Mercer Member and the uppermost beds of the Sharon Member. The Upper Sharon "aquifer" is defined as all strata investigated below the sandstone marker bed during this investigation. This zone is also heterogeneous, but is generally more coarse-grained than the intermediate units. The strata correspond to part of the shale unit of the Sharon Member.

Groundwater in the water table aquifer beneath the site flows southward and eastward (see Figures 1-7 and 1-8) and does not vary much on a seasonal basis, although the eastward component is apparently more important during periods of higher water table. Flow from the site in these materials for the September 1986 data set is estimated to be between 2,000 gpd and 68,000 gpd, of which 65% to 98% is lateral within the aquifer. The remaining 2 to 35% moves downward into bedrock, and could potentially carry contaminants to deeper aquifers. There is also some northeasterly flow on the northern portion of the site. The water table is generally 5 to 12 ft. below grade.

The onsite ponds are similar in elevation to the water table, indicating that they may be hydraulically connected to that aquifer. When the water table is high (above 1085 ft. msl at the extreme downgradient portions of the site), some groundwater may discharge to the drainage ditches on the southern and eastern perimeter of the site. The onsite ponds and the marshy area east of the site may also act as discharge areas during high water table periods.



#### LEGEND



MONITORING WELL



PIEZOMETER

1090.08 HYDRAULIC HEAD, (FT.)



WATER-TABLE CONTOUR LINE, DASHED WHERE TENTATIVE (CONTOUR INTERVAL = 2 FT.)



FLOW LINE



SCALE IN FEET

FIGURE 1-7  
WATER-TABLE CONTOUR  
MAP FOR JUNE 1986  
SUMMIT NATIONAL FS

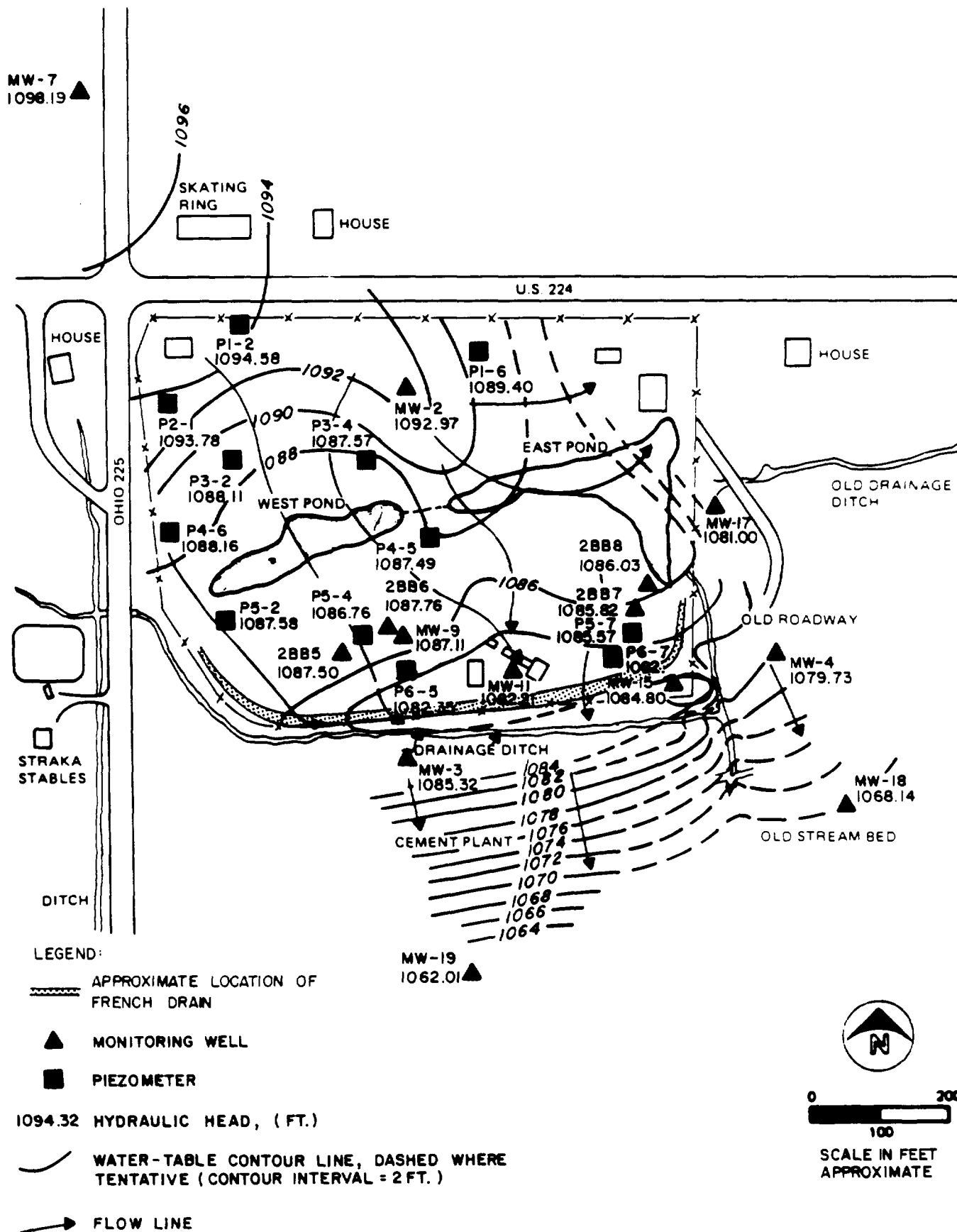


FIGURE 1-8  
WATER-TABLE MAP  
FOR SEPTEMBER 1986  
SUMMIT NATIONAL FS

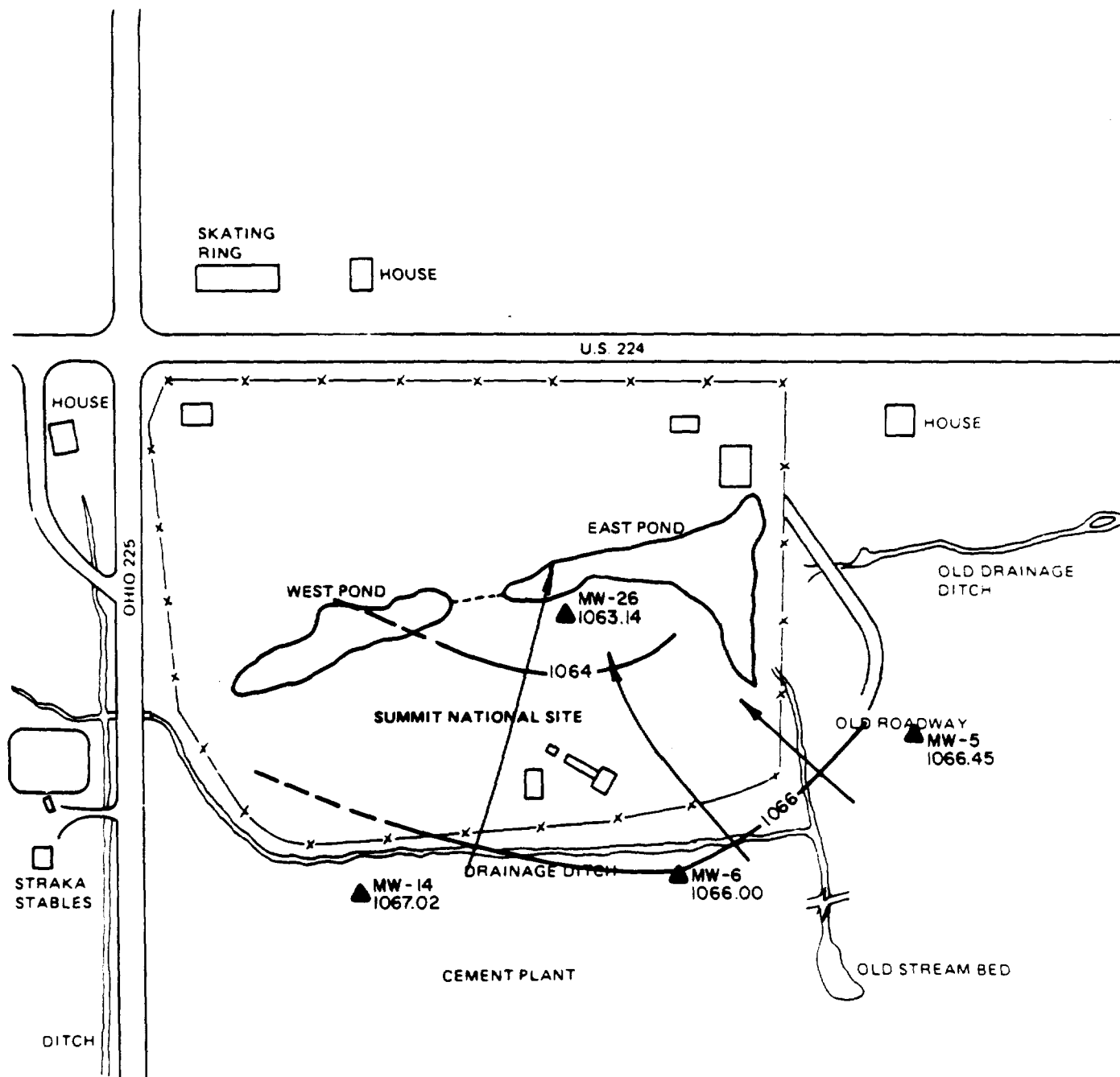
A french drain was installed during initial remedial measures and, although construction reports are not available, field observations and design drawings indicates that the drain penetrates to a depth of 15 to 20 feet below grade. This drain may act as a partial groundwater discharge point even when the water table is low. Although the discharge area of the drain is not documented, it would have to be at an elevation lower than the water table for the drain to actually function. Ground surface elevations consistently below the onsite level of the water table occur only at the southeastern site perimeter, making this the likely discharge point for the french drain.

In summary, the water-table aquifer may discharge to the onsite ponds, the french drain, and the marshy area adjacent to the site. During periods of high groundwater levels, the drainage ditches along the site perimeter also act as discharge areas. All of these features, however, are relatively shallow, and groundwater can pass beneath them at depth. Because of this, groundwater flow probably continues southward, eastward, and northeastward from the site until low elevations are encountered.

Groundwater flow direction in the intermediate group cannot be characterized as a whole due to the high heterogeneity of the strata in this zone. In the strata above and below the Unnamed Limestone, lateral flow is southeastward in the upper portion and westward in the lower portion.

Flow beneath the site in the upper strata between the base of Unnamed Coal #1a and the Unnamed Limestone is estimated to be between 75 and 100 gpd. Flow in the lower beneath the base of the Unnamed Limestone is estimated to be between 15 and 30 gpd. Although these directions and quantities are estimates, the magnitudes of flow and velocity indicate that lateral flow within this zone is of minor importance.

Groundwater in the Upper Sharon aquifer flows northward. (Figure 1-9) The absolute flow quantity in this zone cannot be calculated because the total thickness is not known, but flow in the approximately 45 feet penetrated is estimated as between 250 and 1,500 gpd, based on the minimum and maximum hydraulic conductivity estimates for Upper Sharon wells penetrating sandstone.



# LEGEND:

▲ MONITORING WELL

1066.45 HYDRAULIC HEAD (FT.)

— EQUIPOTENTIAL LINE, DASHED WHERE TENTATIVE  
(CONTOUR INTERVAL = 2 FT.)

→ FLOW LINE



SCALE IN FEET

NOTE All locations of structures and physical features approximate.

SOURCE Modified from USEPA

FIGURE 1-9  
PIEZOMETRIC SURFACE ON THE  
UPPER SHARON AQUIFER  
SUMMIT NATIONAL FS

Vertical gradients within bedrock vary across the study area. The gradient between the water-table aquifer and all deeper strata is downward at all locations. The quantity of downward flow from the contaminated portion of the water-table aquifer is estimated at 1,600 to 1,800 gpd. In bedrock, vertical components are upward at the southern portion of the site and downward in the central portion.

The area of downward gradient in bedrock is important because it occurs beneath the area of waste disposal (the southern half of the site). Downward flow in this area could transport contaminants from the water-table aquifer to the Upper Sharon aquifer. The quantity of downward flow is estimated at 9,400 to 31,000 gpd. These values are much higher than the estimated flows downward from the water-table aquifer. It appears that the ratio of vertical to horizontal hydraulic conductivity may decrease with depth. The vertical flow in the intermediate units is much more important than lateral flow. Assuming a porosity of 10%, the flow velocity in this zone is estimated at 0.05 to 0.2 ft/day (based upon the horizontal to vertical hydraulic conductivity ratio of 1.5).

Hydraulic conductivity values from falling-head tests are shown on Figures 1-4b and 1-5b. Values for the water-table aquifer, which include fill, till and bedrock through the base of Unnamed Coal #1, ranged from  $1 \times 10^{-5}$  cm/sec. to  $3 \times 10^{-3}$  cm/sec., with no clear separation in hydraulic conductivity between the various materials. Hydraulic-conductivity estimates for the Upper Sharon aquifer ranged from  $1 \times 10^{-5}$  cm/sec. to  $3 \times 10^{-4}$  cm/sec. For the intermediate unit, the distribution of hydraulic conductivities according to apparent water-yielding lithology, as reported in the RI, is as follows:

<u>Rock Type</u>	<u>Observed Range of Hydraulic Conductivity (cm/sec.)</u>
Sandstone	$3 \times 10^{-6}$ to $6 \times 10^{-6}$
True Coal	$6 \times 10^{-7}$ to $6 \times 10^{-5}$
Siltstone and Shale	$9 \times 10^{-6}$ to $1 \times 10^{-5}$

#### 1.5.2 Surface Water Hydrology

The site's existing drainage pattern is shown on Figure 1-10. Surface water flow originating in the area west of the site is conveyed in a drainage ditch along the outside of the site's south boundary. This south boundary drainage ditch flows in an easterly direction until joining a southerly flowing drainage

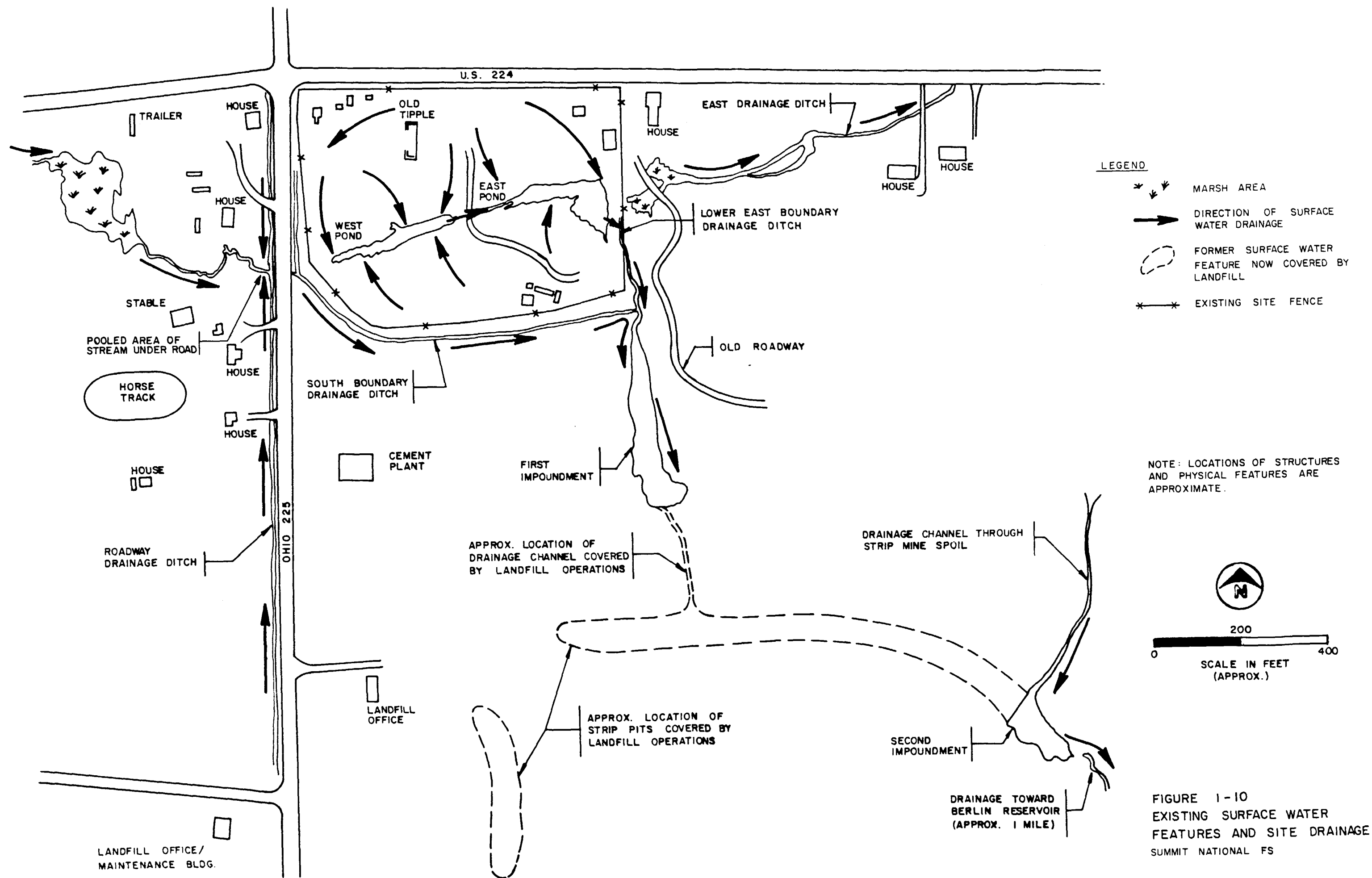
ditch near the site's southeast corner. This southerly flowing ditch carries the flow from the onsite ponds. The onsite ponds (east pond and west pond) were apparently formed when a drainage ditch which crossed through the site prior to 1975 was dammed in several places. The two ponds were estimated to contain a combined total of approximately 500,000 gallons of water based on surface area and water depths recorded during the RI field investigations. The west pond empties into the east pond by way of a concrete culvert while the east pond conveys water offsite through three metal pipes into the southerly flowing drainage ditch just outside the site's lower east boundary. The site is graded such that onsite surface runoff flows into the east and west ponds.

From the junction of the two offsite ditches, drainage flows in a southerly direction along an old mine spoil channel until being impounded by a solid waste embankment located about 500 feet south of the site. A second impoundment is located approximately 950 feet southeast of the first impoundment. Discharge from this impoundment continues flowing southward within the watershed of the Berlin Reservoir, located approximately 4,500 ft. southeast of the site, which is used as a water supply source and for recreation (Figure 1-11). Since flow in these ditches occurs only in response to precipitation events, no estimates of flow quantities actually reaching the Berlin Reservoir were able to be made.

#### 1.5.3 Nature and Extent of Contamination

A detailed discussion of the RI sampling program and the analytical results are presented in Chapters 2 through 4 of the final RI report dated February 1, 1988. Contamination is defined by the concentrations of chemicals that are a result of the site activities or releases attributable to the site. They are concentrations that are above the values expected to be present in the environmental media if unaffected by the site (i.e., background). Data collected during the RI indicate contamination of various media has occurred on and in the vicinity of the Summit National Site. The following sections summarize the results of the RI sampling effort by potential operable units.





SOURCE: USGS TOPOGRAPHIC MAP  
DEERFIELD QUADRANGLE,  
OHIO, DATED: 1960,  
PHOTOREVISED: 1979,  
SCALE: 1" = 2000'.

LEGEND

--- DRAINAGE DIVIDE

■ RIVER AND RESERVOIR  
AREA

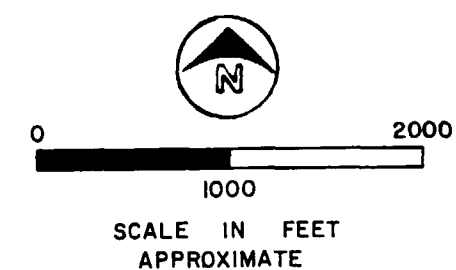
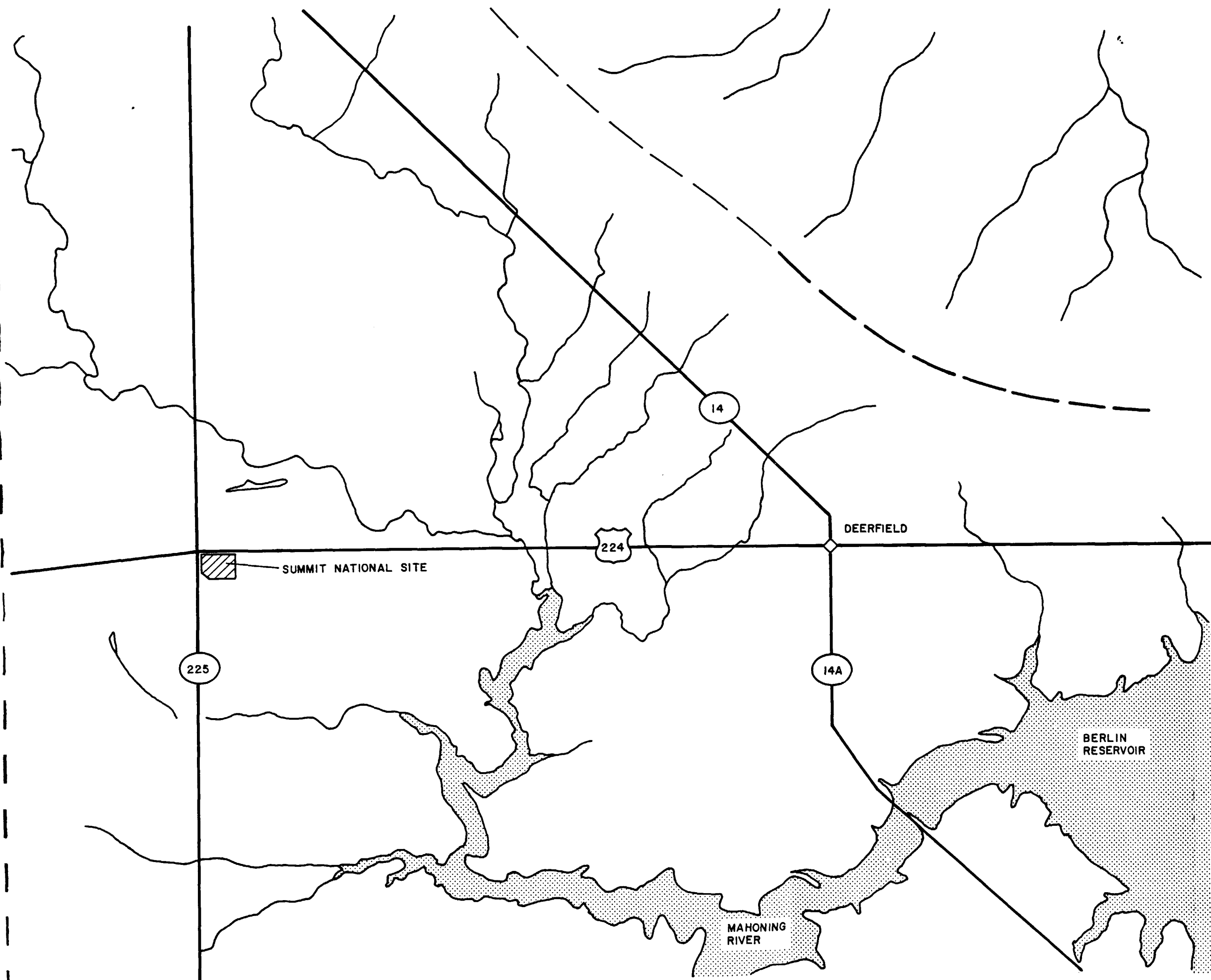


FIGURE 1-11  
LOCATION OF MAJOR  
SURFACE WATER FEATURES  
SUMMIT NATIONAL FS



Groundwater: Shallow onsite groundwater in the water-table aquifer and uppermost intermediate unit is contaminated with a number of organic and inorganic compounds. Table 1-1 summarizes the most representative contaminants present in the shallow onsite groundwater. Deeper portions of the intermediate units are discussed later. For purposes of this report, a chemical has been called a most representative contaminant if its concentration is greater than the background concentration (MW-7) and it has a discernible, flow-related pattern of concentration.

Samples from wells screened across the water table may have contained some free product, so the analytical results may not be indicative of actual concentrations dissolved in groundwater. Free product was observed in well 2BB5, but was not analyzed separately. Free product was also encountered in Monitoring Well #9 (MW-9), screened below the water table. The location of the monitoring wells installed during the RI are shown on Figure 1-12.

Of the contaminants observed in the groundwater, the highest concentrations were observed in the southwestern quarter of the site, in the vicinity of water-table wells 2BB5 and 2BB6.

This area was the location of a former concrete-block pit which was used for chemical mixing prior to disposal. Observations during excavation of test pits and the presence of free product in 2BB5, which is screened across the water table, indicate that oily contaminants occur as a separate phase on the water table. The oil phase was not analyzed separately. The water sample may have contained some free product. The other well which contained free product, MW-9, is screened at the base of the aquifer, so the oils encountered must constitute a free phase of compounds which are heavier than water.

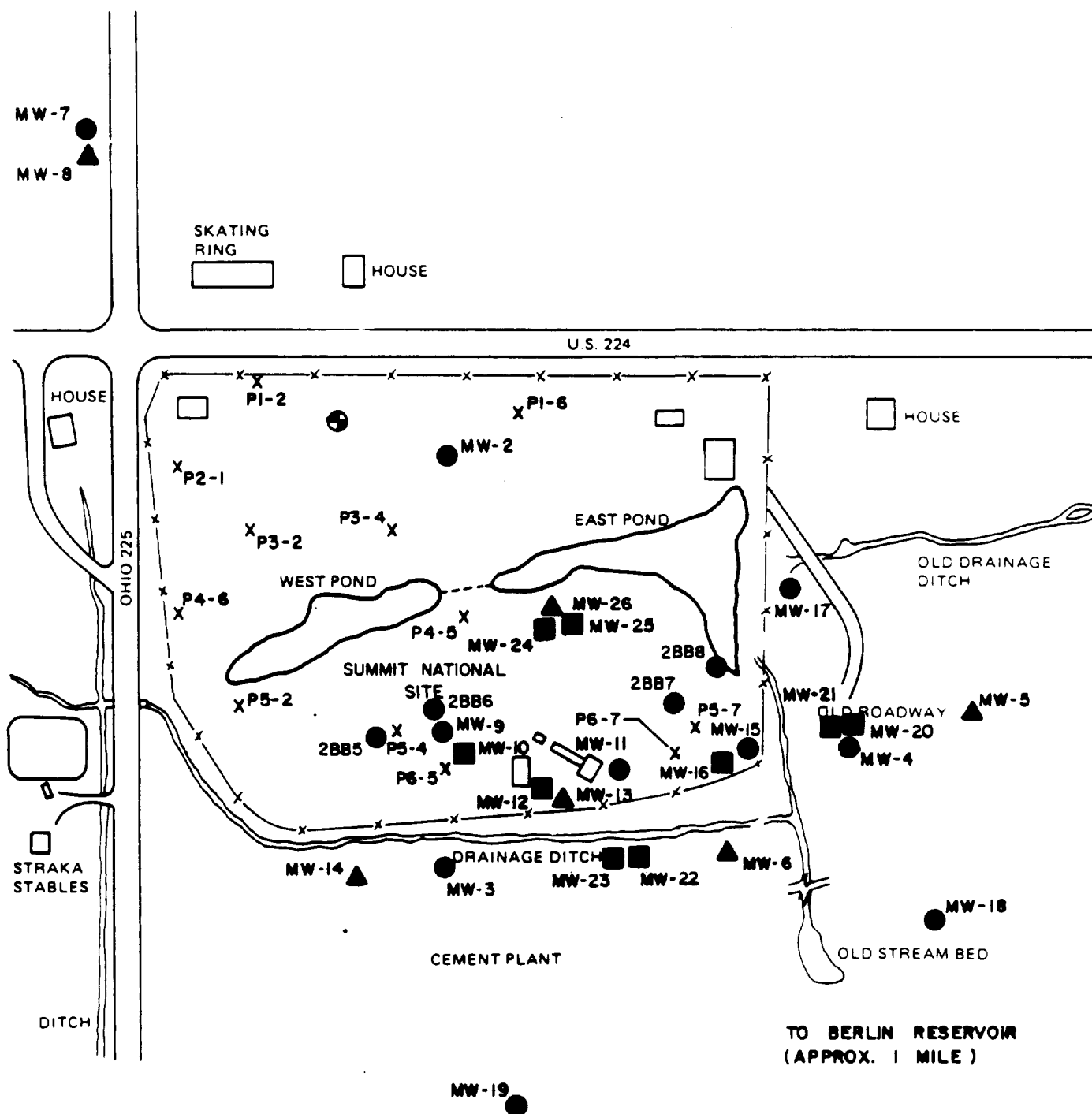
Concentrations of most organic contaminants decrease across the southern half of the site, from west to east. This pattern indicates that the primary source of organic contaminants is in the southwestern quarter of the site. Lower concentrations are found in the eastern portion of the waste area. Leaking buried drums and the former concrete block pit were observed in the southwest quarter of the site..

TABLE 1-1  
SUMMARY LIST OF MOST REPRESENTATIVE CONTAMINANTS IDENTIFIED  
IN THE SHALLOW ONSITE GROUNDWATER  
SUMMIT NATIONAL SITE

Contaminant	Maximum Conc. (ug/l)	Background Conc. (ug/l)
<u>VOLATILES</u>		
Methylene Chloride	24,000	2
Acetone	1,300,000	4
1,1-Dichloroethane	12,000	ND
1,2-Dichloroethane	115,000(1)	ND
2-Butanone	650,000	14
1,1,1-Trichloroethane	53,000	ND
Trichloroethene	27,000	ND
4-Methyl-2-Pentanone	62,000	ND
Toluene	18,000	16(1)
Ethylbenzene	11,000	ND
<u>SEMI-VOLATILES</u>		
4-Methylphenol	310	ND
2,4-Dimethylphenol	130(1)	ND
Phenol	7,000	ND
Isophorone	2,600	ND
Naphthalene	565(1)	ND
2-Methylnaphthalene	360(1)	ND
Bis(2-ethylhexyl)Phthalate	7,250	5
<u>INORGANICS</u>		
Aluminum	4,820	801
Arsenic	1,550	ND
Barium	284	ND
Cadmium	58	ND
Iron	982,000	99,410
Manganese	72,200	6,785
Tin	122	ND

Note:

\*MW--7 used for background concentration  
(1) Average of two duplicates.



TO BERLIN RESERVOIR  
(APPROX. 1 MILE)

#### LEGEND

- MONITORING WELL IN WATER-TABLE AQUIFER
- MONITORING WELL IN INTERMEDIATE ZONE
- ▲ MONITORING WELL IN UPPER SHARON AQUIFER
- ⊕ ABANDONED PRODUCTION WELL ( DEPTH UNKNOWN )
- X PIEZOMETER IN WATER-TABLE AQUIFER



SCALE IN FEET  
APPROXIMATE

NOTE: All locations of structures and  
physical features approximate.

SOURCE: Modified from USEPA.

FIGURE 1-12  
LOCATION OF MONITORING WELLS  
SUMMIT NATIONAL FS

High levels of some organics contaminants were observed in MW-10. This well is completed below the base of the water-table aquifer. The presence of these substances indicates that some contamination extends below the water-table aquifer.

Of the deeper intermediate wells, high levels of contaminants were detected in only MW-24, an onsite intermediate well, as compared to MW-7, a background well completed in the water table. The water-table aquifer is considered appropriate as background for the intermediate units because the water-table aquifer recharges the intermediate units. Trace levels of contaminants were detected in MW-25, an intermediate well completed next to MW-24, but open to a shallower interval. MW-24 contained many of the substances identified as site-related contaminants in the water-table aquifer (Table 1-1). MW-25 also contained some of these same compounds, but at much lower levels. The presence of contaminants in these wells and intermediate wells MW-10 and MW-16 indicate that the intermediate units beneath the site are contaminated. The groundwater moving downward from the water-table aquifer, although not large in quantity, is apparently sufficient to adversely affect water quality in these units. The contaminants may move laterally in permeable zones, but movement is primarily downward in the areas where downward gradients exist.

In the Upper Sharon aquifer, MW-14 and MW-8 are appropriate as background monitoring points. The only groundwater sample from the Upper Sharon which contained any organic substances above background levels was MW-13, which had 46 ug/l of TCE. It is not likely that this substance is migrating from the site to the Upper Sharon aquifer at this location because the well is on the upgradient end of the site and the vertical hydraulic gradient is upward from the Upper Sharon. The seal on this well is suspect. The sample from this well is not believed to be a true representation of water quality at that location. This well will be grouted during remedial actions.

Nine residential wells in the vicinity of the site were sampled. None of these wells, which represent water from the intermediate units and the Upper Sharon aquifer, had levels of organic contaminants above background.

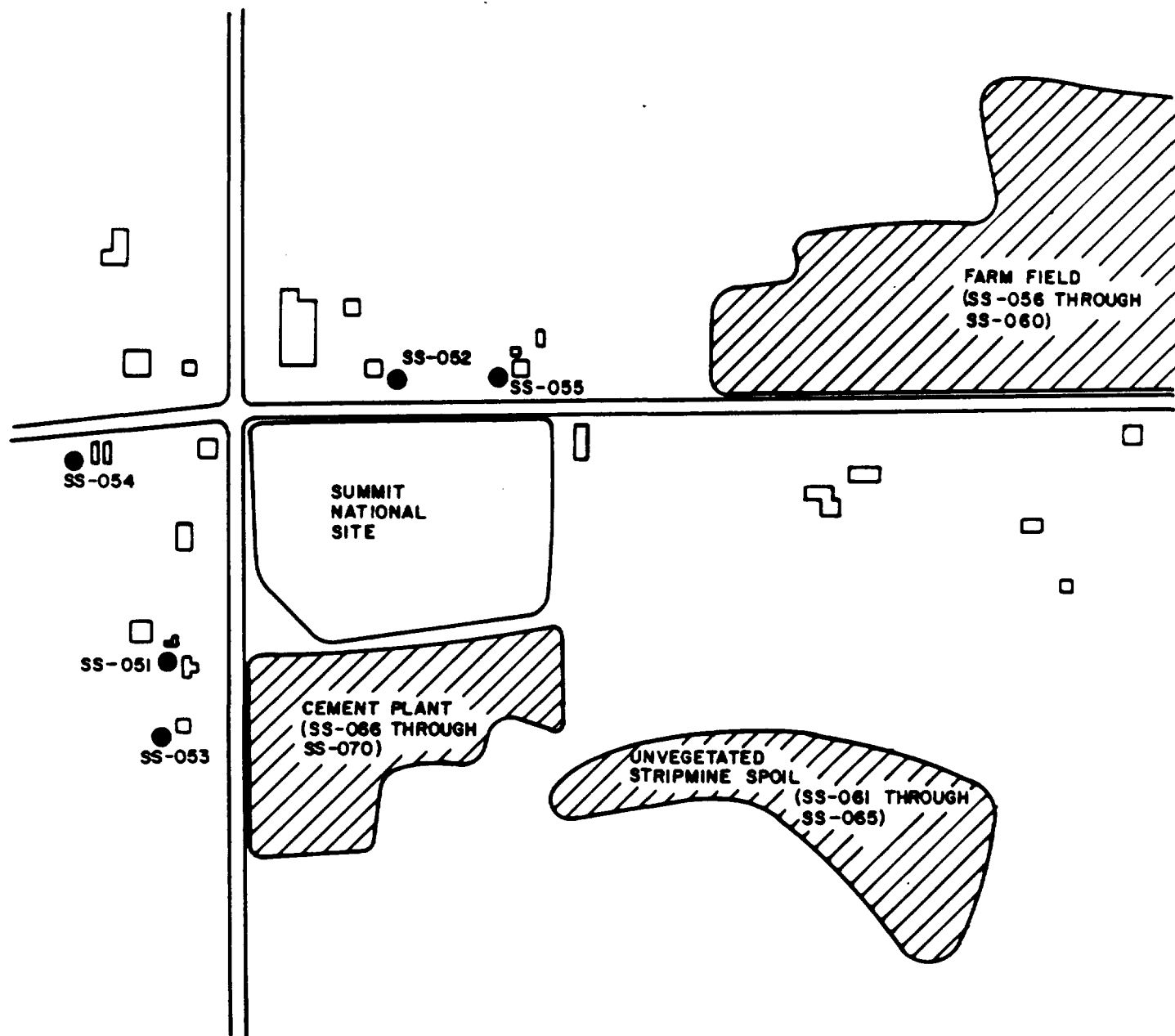
Metals which were detected in concentrations above background in the onsite water-table aquifer included aluminum, arsenic, barium, cadmium, iron, manganese, and tin. Coal and coal refuse produce characteristic acid mine drainage, and the detection of some metals can be attributed to the effects of mining at the site, rather than to waste disposal. Aluminum, arsenic, iron, and manganese can all be released by coal and coal refuse (Davis and Boegly, 1981; Hem, 1985). The only metallic contaminants detected on site which cannot be attributed to typical acid mine drainage are barium and chromium. Chromium tends to be stratified in the water-table aquifer, occurring preferentially in the lower portion of the unit.

Neither barium nor chromium were detected above background concentrations in the samples from intermediate units or the Upper Sharon aquifer indicating that the site is not contributing these substances to the deeper strata.

None of the residential well samples exceeded background levels of barium or chromium, with the exception of slightly elevated concentrations of barium in the Watson and Lockridge wells. These wells had barium concentrations of 184 and 86 ppb respectively. The Watson well is located adjacent to and downgradient of the site, and the barium in that well may be due to the site. It is unlikely that the site is the source of the elevated barium concentration detected in the Lockridge. Although the Lockridge well is downgradient from the site, it is not within the influence zone of site migration in the Sharon unit. The Lockridge well is located approximately 1/4 mile from the site and the O'Neil well sample, located nearby, had a much lower level of barium (28 ppb). The location of the residential wells are shown on Figure 1-13.

Onsite Soils: Background soil sample locations are shown on Figure 1-14. The background soils representing local residential, farm and strip mine soil had detectable background levels of numerous organic and inorganic compounds. The source of these contaminants is unknown based on the data obtained during the RI.

Onsite soil sampling locations are shown on Figure 1-15. The onsite surface and subsurface soils (down to 8 ft.) were found to have levels of numerous organic and inorganic contaminants that were up to several orders of magnitude above all background and residential background (surface only), indicating a



#### LEGEND

- SS-051 SOIL SAMPLING LOCATION
- ▨ APPROXIMATE SAMPLING AREA

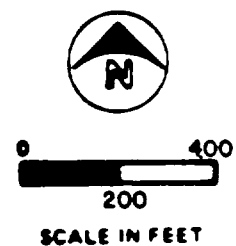
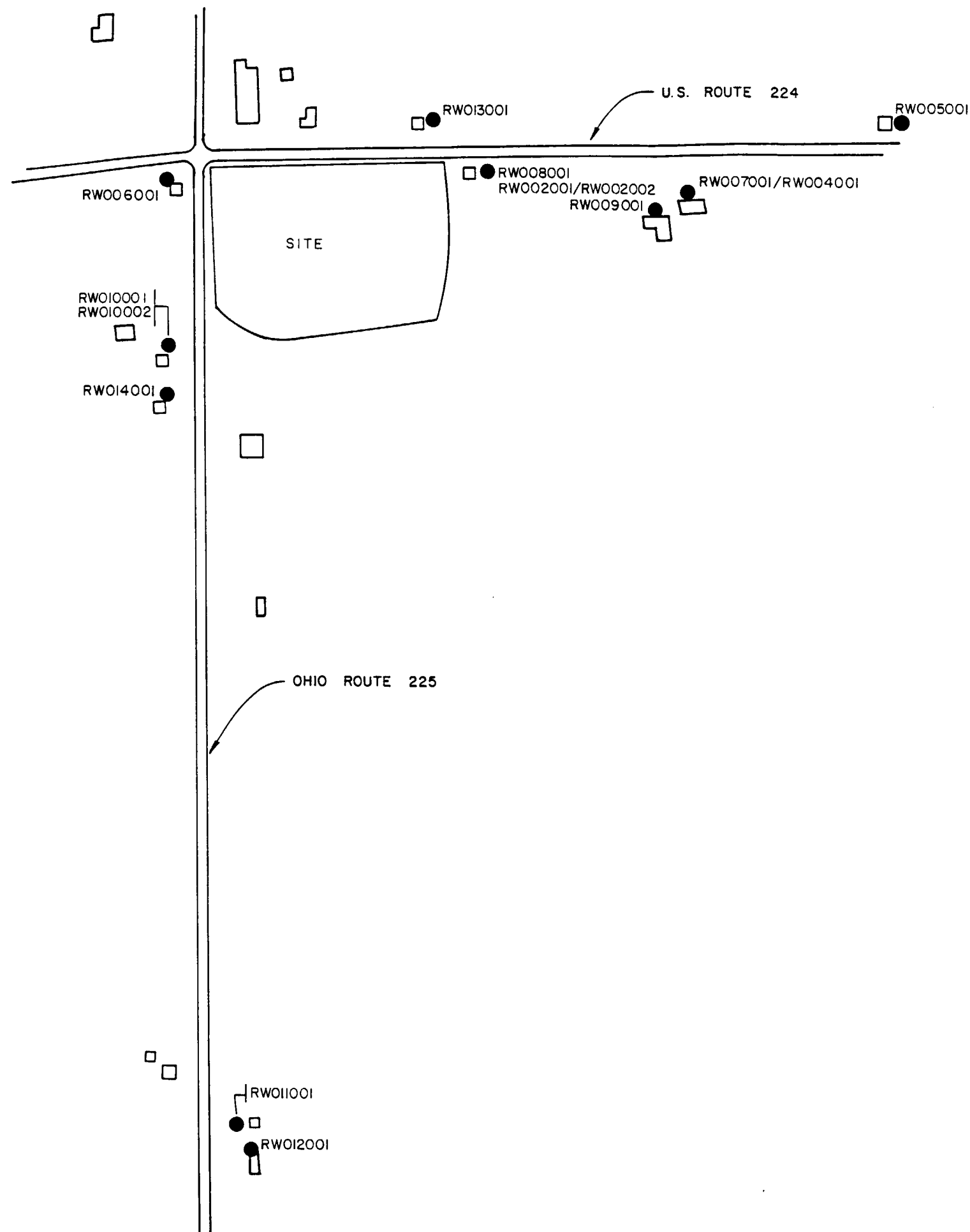


FIGURE 1 - 14  
BACKGROUND  
SOIL SAMPLING LOCATIONS  
SUMMIT NATIONAL FS





LEGEND  
 ● RW007001 LOCATION AND DESIGNATION OF  
 RESIDENTIAL WELL SAMPLE

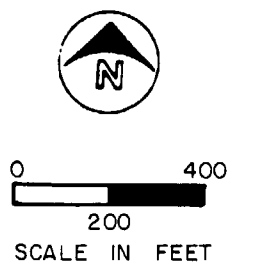


FIGURE 1 - 13  
 LOCATION OF SAMPLED  
 RESIDENTIAL WELLS  
 SUMMIT NATIONAL FS

LEGEND:

⊕ PHASE II SOIL BORING  
SAMPLE SENT TO CLP

⊕ PHASE II PIEZOMETER  
SAMPLE SENT TO CLP

ALL OTHERS ARE PHASE I  
SAMPLES OBTAINED WITH  
STAINLESS STEEL BUCKET  
AUGER AND SENT TO CLP

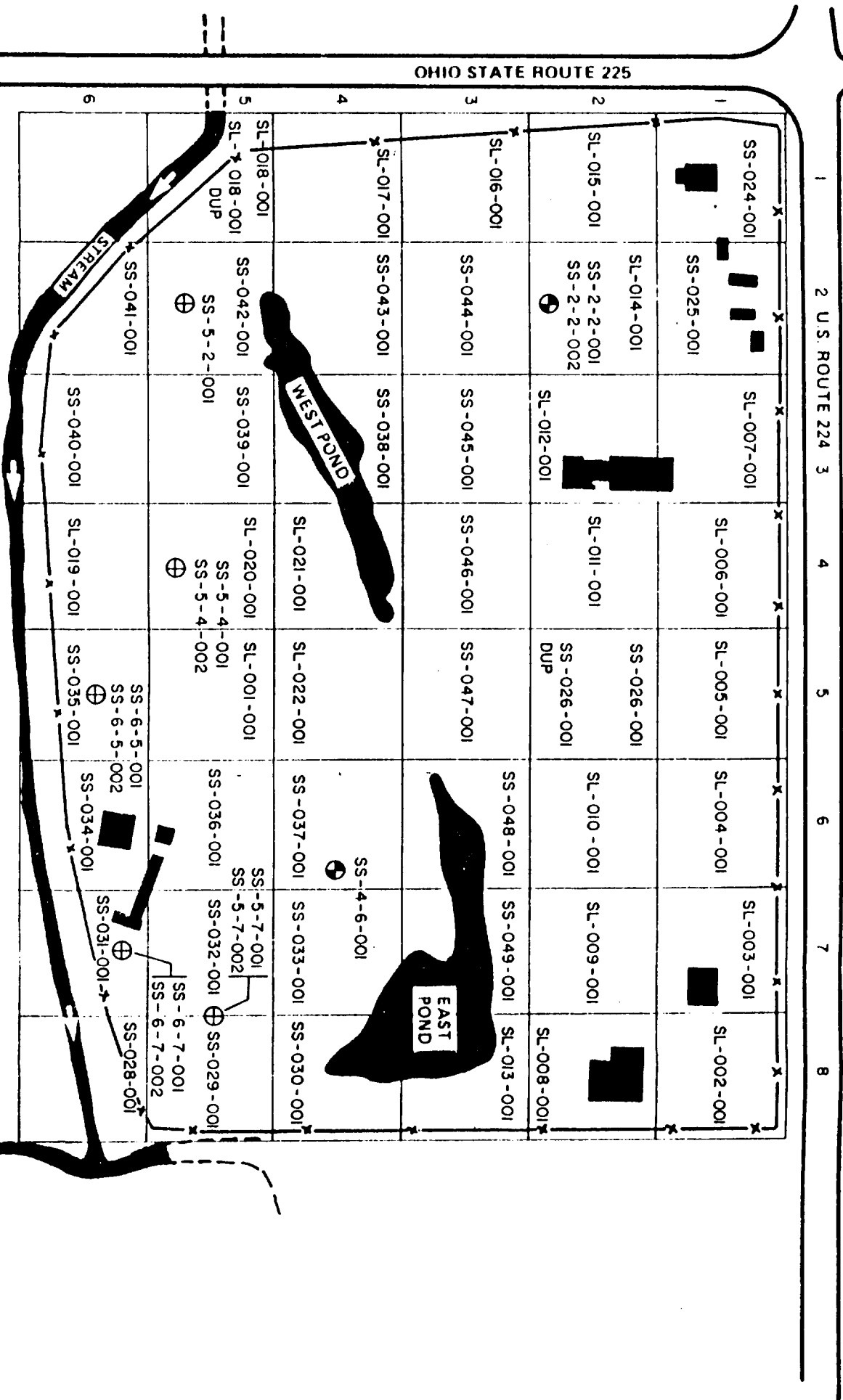
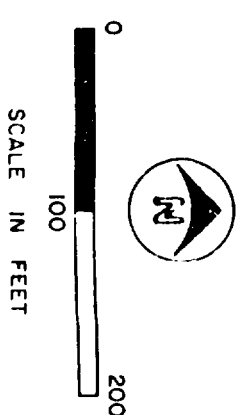


FIGURE 1 - 15  
ONSITE SURFACE SOIL  
SAMPLING LOCATIONS  
SUMMIT NATIONAL FS

TABLE 1-2 (cont'd)

Page 2

Parameters	No. of Times Detected (1)	Mean Concentrations (2)(3)	Upper 95% Confidence Limit in Background Samples (2)	Upper 95% Confidence Limit in Residential Soil Samples (2)
<u>BNA (Cont'd)</u>				
2,4-Dimethylphenol	5	213	ND	ND
Benzoic Acid	6	370	297	885
1,2,4-Trichlorobenzene	6	293	ND	ND
Naphthalene	30	1965	1438	1214
2-Methylnaphthalene	30	1856	1587	1726
Hexachlorocyclopentadiene	3	84475	ND	ND
Acenaphthene	7	69	35	106
Diethylphthalate	8	95	ND	ND
Fluorene	10	81	23	71
N-Nitrosodiphenylamine	5	79	ND	ND
Hexachlorobenzene	21	8811	61	196
Phenanthrene	28	1095	1091	1122
Anthracene	2	239	69	199
Di-N-Butylphthalate	23	1538	86	213
Butylbenzylphthalate	11	592	ND	ND
Bis(2-ethylhexyl)Phthalate	47	103511	52	107
Di-N-Octyl Phthalate	30	7925	ND	ND
<u>Pesticides</u>				
Heptachlor Epoxide	2	1	ND	ND
PCB's (4)	19	17058	ND	ND
<u>INORGANICS</u>				
Antimony	11	17	4	ND
Arsenic	53	17	19	24
Barium	61	103	100	133
Beryllium	36	0.59	0.726	1.074
Cadmium	13	3	3	3
Calcium	61	8982	7316	4289

TABLE 1-2 (cont'd)  
Page 3

Parameters	No. of Times Detected (1)	Mean Concentrations (2)(3)	Upper 95% Confidence Limit in Background Samples (2)	Upper 95% Confidence Limit in Residential Soil Samples (2)
<u>INORGANICS (Cont'd)</u>				
Chromium	61	27	18	23
Cobalt	48	11	13	18
Copper	61	37	29	43
Cyanide	37	4	1.186	2.895
Iron	61	39531	29572	30494
Lead	61	37	117	290
Magnesium	60	2827	2782	4142
Manganese	61	365	1003	1362
Mercury	36	0.167	0.098	0.289
Nickel	58	26	19	30
Selenium	2	0	ND	ND
Sodium	34	164	143	ND
Tin	7	3	ND	ND
Vanadium	61	28	26	32
Zinc	61	168	113	197

Notes:

- (1) Out of total 61 samples
- (2) Units ug/kg dry weight for organics, mg/kg for inorganics
- (3) Mean calculated using zero for samples where parameters not detected
- (4) Arochlor 1232, 1242, 1248, 1254

site-related contamination problem. Similar numbers and types of contaminants found in the 6 to 8 ft. soils were also found in the surface soils. A summary of surface soil contamination is presented in Table 1-2. Soil contamination is widespread at the site. The volatile organic contamination was found in the greatest concentrations in the south central area of the site near the concrete block pit. The base/neutral/acid extractable (BNA) organics and PCB contaminants were more widespread toward the north, and inorganic contamination showed no identifiable pattern of contamination.

Offsite Soils: The location of offsite and perimeter soil sample locations are shown on Figure 1-16. Offsite soils south of the site at the cement plant also contained organic and inorganic contaminants that exceeded background concentrations. Contamination was found at depths of up to 6 ft. The eastern offsite soils (within 100 ft. of the site) also had contaminants, particularly PCBs, at levels that exceeded background. A summary of parameters exceeding background in the cement plant and eastern perimeter offsite surface soil is presented in Table 1-3. The distribution and location of total organic fraction contamination in each sample is shown on Figure 1-16.

Surface Water: Based on field observations during the RI site investigation, surface water flow near the site exists only in response to precipitation. This accounts for the lack of flow data and inability to collect surface water samples that would be representative of upstream or background quality. Therefore, background concentrations are assumed to be zero for comparative purposes. The onsite ponds are contaminated with both organic and inorganic constituents at levels that exceed background. The east pond was found to have consistently higher levels of contamination than the west pond, based on total fraction concentrations. There is offsite transport of contaminants via surface water since the east pond is the onsite surface water body that directly discharges off site to the eastern drainage ditches during high flow periods. Onsite and offsite surface water sample locations are shown on Figure 1-17.

Data contained in the RI indicated that offsite surface water is contaminated with organic constituents and metals at levels that exceed background. The south drainage ditch (downstream) is apparently being affected by runoff from the site, as

TABLE 1-2

SUMMARY LIST OF ORGANIC AND INORGANIC PARAMETERS IDENTIFIED  
IN ONSITE SURFACE SOILS THAT EXCEED BACKGROUND  
SUMMIT NATIONAL FEASIBILITY STUDY

Parameters	No. of Times Detected (1)	Mean Concentrations (2)(3)	Upper 95% Confidence Limit in Background Samples (2)	Upper 95% Confidence Limit in Residential Soil Samples (2)
<u>VOLATILES</u>				
Methylene Chloride	22	406	ND	ND
Acetone	25	9484	ND	ND
Carbon Disulfide	3	0	ND	ND
1,1-Dichloroethene	2	1	ND	ND
1,1-Dichloroethane	5	1	ND	ND
Trans-1,2-Dichloroethene	7	9	ND	ND
Chloroform	10	72	ND	ND
1,2-Dichloroethane	9	3177	ND	ND
2-Butanone	15	1682	ND	ND
1,1,1-Trichloroethane	31	2216	ND	ND
Trichloroethene	38	8017	ND	ND
1,1,2-Trichloroethane	2	1	ND	ND
Benzene	30	3	ND	ND
2-Hexanone	5	146	ND	ND
4-Methyl-2-Pentanone	2	739	ND	ND
Tetrachloroethene	12	97	ND	ND
Toluene	40	7002	13	11
Chlorobenzene	9	62	ND	ND
Ethylbenzene	18	4882	ND	ND
Total Xylenes	27	20440	2	ND
<u>BNA</u>				
Phenol	8	1304	ND	ND
1,3-Dichlorobenzene	2	11	ND	ND
1,4-Dichlorobenzene	4	304	ND	ND
1,2-Dichlorobenzene	9	3811	ND	ND
2-Methylphenol	6	165	ND	ND
4-Methylphenol	4	29	ND	ND
Isophorone	4	111	ND	ND

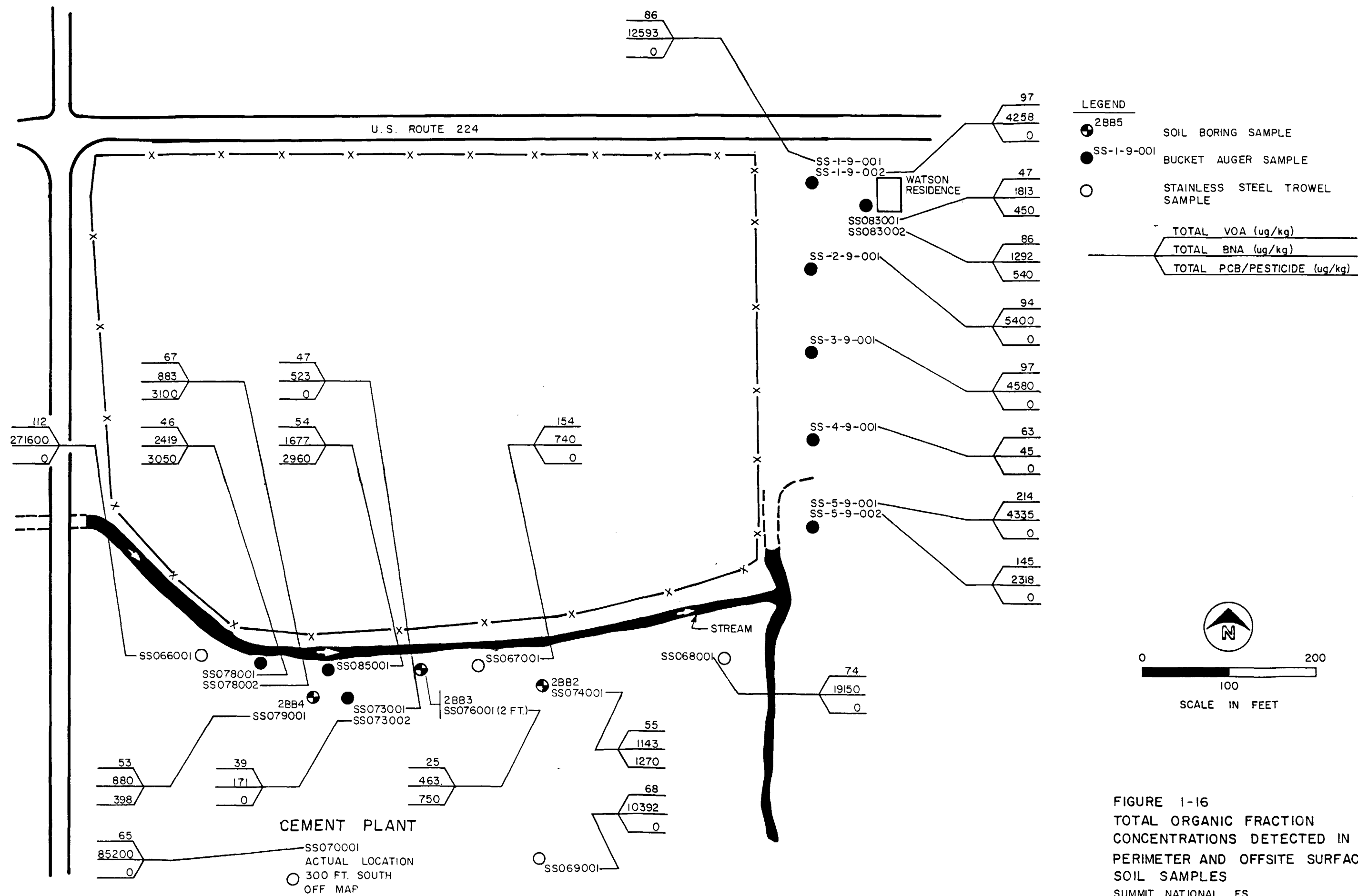


TABLE 1-3

SUMMARY OF OFFSITE SURFACE SOIL PARAMETERS EXCEEDING BACKGROUND  
SUMMIT NATIONAL FEASIBILITY STUDY

Parameters	Eastern Perimeter Soils			Cement Plant Surface Soils			Upper 95% Confidence Limit in Background
	No. of Times Detected(1)	Range of Detected Concentration	Mean Concentration(3)	No. of Times Detected(4)	Range of Detected Concentrations(2)	Mean Concentration(2)(3)	
<b><u>VOLATILES</u></b>							
Toluene	7	4J-28	11	--	--	--	13
Methylene Chloride	--	--	--	6	2J-18	3	ND
1,2-Dichloroethane	--	--	--	2	4J-16	1	ND
<b><u>BNA</u></b>							
Benzoic Acid	1	500J	56	--	--	--	297
Naphthalene	7	125J-2000	872	7	229J-36000**	3628	1438
2-Methynaphthalene	7	125J-3200	1329	11	90J-55000**	5353	1587
Acenaphthene	1	240J	27	--	--	--	35
Dibenzofuran	5	120J-870	260	4	57J-12000**	1069	349
Fluorene	1	480	53	1	100J	8	23
Phenanthrene	7	204J-6500	1334	7	136J-30000**	3338	1091
Anthracene	1	910	101	2	2500J, ** - 5500J, **	615	69
Di-n-butylphthalate	7	60J-10868	279	10	82J-16778	425	86
Fluoranthene	5	86J-7100	947	5	130J-20000**	2689	594
Pyrene	6	130J-4700	685	5	130J-20000**	2455	512
Butylbenzylphthalate	1	67J	7	--	--	--	ND
Benzo(a)Anthracene	4	88J-3000	429	4	190J-16000**	1787	346
Bis(2-ethylhexyl)Phthalate	4	45J-206J	54	2	330J-469J	61	52
Chrysene	4	83J-2400	315	5	72J-16000**	1999	423
Benzo(b)Fluoranthene	4	120J-3200	462	4	250J-21000**	2511	598
Benzo(k)Fluoranthene	4	120J-3200	462	4	250J-21000**	2511	598
Benzo(a)Pyrene	3	41J-1700	238	4	150J-10000**	1258	301
Indeno(1,2,3-cd)Pyrene	3	41J-1700	238	1	5200J, **	400	150
Dibenz(a,h)Anthracene	2	87J-410	55	--	--	--	31
Benzo(g,h,i)Perylene	4	120J-1200	194	1	3900, J**	300	135
<b><u>PCB's</u></b>	2	450-540	110	6	398-3100	887	ND



TABLE 1-3 (cont'd)  
Page 2

Parameters	Eastern Perimeter Soils			Cement Plant Surface Soils			Upper 95% Confidence Limit in Background
	No. of Times Detected(1)	Range of Detected Concentration	Mean Concentration(3)	No. of Times Detected(4)	Range of Detected Concentrations(2)	Mean Concentration(2)(3)	
<b>INORGANIC</b>							
Aluminum	9	2300-12700	8169	--	--	--	11699
Arsenic	9	9.9-20	13	12	8.7-78	21	19
Barium	9	[53]-295	134	13	[51]-578	166	100
Beryllium	7	[.52]-1.3	.529	--	--	--	0.726
Cadmium	4	[2.8]-4.2	2	--	--	--	3
Calcium	9	[402]-19700	4706	13	[982]-11400	19867	7316
Chromium	9	15-22	18	--	--	--	18
Cobalt	9	[5]-[15]	11	--	--	--	13
Copper	9	29-56	36	13	[17]-119	36	29
Iron	9	26100-40600	30211	13	6120-51700	32186	29572
Lead	9	17-241	99	--	--	--	117
Magnesium	9	[515]-4700	2742	--	--	--	2782
Manganese	9	54J-1350J	512	--	--	--	1003
Mercury	5	.2-1.1	.272	6	0.1-0.52	0.13	0.098
Nickel	9	[18]-30	24	12	[14]-36	25	19
Potassium	9	[1190]-[2230]	1826	--	--	--	2161
Selenium	1	3.3	0	--	--	--	ND
Silver	4	[2.7]J,R-[4.5]J,R	2	--	--	--	5
Sodium	6	[674]-[1150]	581	5	[766]-[5090]	676	143
Tin	2	[16]-[22]	4	--	--	--	ND
Vanadium	9	[16]-[25]	20	--	--	--	26
Zinc	9	36-380	155	--	--	--	113

**Notes:**

- (1) Out of a total of 9 samples
- (2) ug/kg dry weight for organics, mg/kg for inorganics
- (3) Mean calculated using zero for samples where parameters not detected
- (4) Out of a total of 13 samples
- [ ] Positive values less than the contract required detection limit
- J Estimated value
- E Estimated due to interference
- R Spike recovery not within control limits
- Below background level
- S Value determined by standard addition
- B Found in laboratory blank
- \*\* Analyzed at medium concentration



is the lower east drainage ditch. Samples from the lower east drainage ditch were also found to have similar compounds as the onsite surface water samples, particularly the east pond. Offsite surface water sample locations are shown on Figure 1-17. This reach of the ditch receives outfall from or seepage through the eastern onsite pond and is being contaminated by the site. A summary of organic and inorganic parameters identified in the onsite surface water, the south ditch (downstream), and the lower east drainage ditch are presented in Table 1-4.

Onsite Sediment: As previously described, onsite surface soils at the Summit National Site were contaminated in all fractions analyzed. Since the onsite surface drainage is directed into the two ponds, the sediments deposited in the ponds are water transported site surface soils. Organic and inorganic contaminants were detected in the sediments in the east and west ponds at levels that exceeded background surface soils. Sediment sampling locations are shown on Figure 1-18. The west pond samples had detected concentrations of contamination in the organic fraction higher than the east pond, while the east pond samples had higher levels of inorganics. The levels of contaminants in the onsite sediments also exceeded upstream sediment levels. A summary of organic and inorganic parameters that exceed background is presented in Table 1-5.

Offsite Sediment: Offsite sediment sample locations are shown on Figure 1-18. The offsite sediment in the southern ditch (upstream and downstream) and lower east drainage ditch was found to have concentrations of organics that exceed background surface soils and upstream sediments. These offsite sediments contained higher concentrations in the BNA fraction than in the volatile fraction. A summary of the organic and inorganic compounds detected in the offsite sediment from the south ditch and the lower drainage ditch is presented in Table 1-6.

Air: The interpretation of results of the air sampling and air monitoring performed at the Summit National Site suggested that onsite or offsite air contamination had not occurred and should not occur unless there is a surface disturbance of the site. Radiation in excess of background was not detected onsite.

Permanent Structures: In general, the permanent structures remaining on site are in poor condition, but some could serve as temporary storage facilities if needed during some future site activities.

TABLE 1-4  
SUMMARY LIST OF ORGANIC AND INORGANIC PARAMETERS IDENTIFIED IN ONSITE SURFACE WATER  
SOUTH DITCH-DOWNSTREAM AND LOWER EAST DRAINAGE THAT EXCEED BACKGROUND  
SUMMIT NATIONAL FEASIBILITY STUDY

Parameters	Onsite Surface Water			Concentration (1) in South Ditch- Downstream <sup>a</sup>	Concentration (1) in Lower East Drainage Ditch
	No. of Times Detected	Range of Detected Concentrations	Mean Concentrations <sup>c</sup>		
<u>VOLATILES</u>					
Vinyl Chloride	ND	ND	ND	7J	ND
Methylene Chloride	4	2B,J-51	9	25B	ND
Acetone	6	30B,J-4000	1324	15B,J	3100
1,1-Dichloroethane	2	3J	1	34	ND
Trans-1,2-Dichloroethene	ND	ND	ND	78	5
1,2-Dichloroethane	4	38-860	295	78	500
2-Butanone	3	118-168	--	138	158
1,1,1-Trichloroethane	3	5-66	13	29	ND
4-Methyl-2-Pentanone	1	78	NA	ND	58
Trichloroethene	ND	ND	ND	6	ND
Tetrachloroethene	1	24	NA	ND	ND
Toluene	3	1J-120	21	ND	ND
Chlorobenzene	1	59	NA	25	ND
Total Xylenes	3	1J-100	17	ND	ND
<u>BNA</u>					
Phenol	2	8J-12	3	107	7J
Aniline	2	227-231	76	ND	283
1,4-Dichlorobenzene	1	49J	NA	ND	ND
1,2-Dichlorobenzene	1	24J	NA	ND	ND
Hexachloroethane	1	14J	NA	ND	ND
Isophorone	2	12-13	4	ND	14
Benzoic Acid	1	47J	NA	ND	31J
Bis(2-ethylhexyl)Phthalate	6	7B,J-25B	--	12B,J	14B,J
Benzo(b)Fluoranthene	1	3J	NA	ND	ND
Benzo(k)Fluoranthene	1	3J	NA	ND	ND
Benzo(a)Pyrene	1	4J	NA	ND	ND
Indeno(1,2,3-cd)Pyrene	1	3J	NA	ND	ND
Dibenz(a,h)Anthracene	1	3J	NA	ND	ND
Benzo(g,h,i)Perylene	1	3J	NA	ND	ND

TABLE 1-4 (cont'd)

Page 2

Parameters	Onsite Surface Water			Concentration (1) in South Ditch- Downstream*	Concentration (1) in Lower East Drainage Ditch
	No. of Times Detected	Range of Detected Concentrations	Mean Concentrations <sup>c</sup>		
<u>PESTICIDES/PCB</u>					
None Detected					
<u>Inorganic Parameters</u>					
Aluminum	5	200-39800	9932	570	10400
Antimony	2	62-121	31	ND	94
Arsenic	2	25-27	9	ND	38+, S
Barium	3	9.9-25	10	ND	220
Beryllium	2	5-7.9	2	ND	ND
Cadmium	3	9-35	11	ND	9
Calcium	6	139000-297000E	216283	3830000E	364000E
Chromium	3	4.2-28	9	ND	22
Cobalt	4	13-123	37	[23]	[15]
Copper	4	11-122	41	[10]	28
Iron	6	3030-68500	23332	8520	131000
Magnesium	6	32500-120000	77647	92900	130000
Manganese	6	3740-8100	6380	3670	8000
Nickel	6	20-322	112	62	46
Potassium	6	3670-12400	8155	9700	11700
Selenium	1	16	--	ND	ND
Sodium	6	14700-72100	44833	142000	312000
Vanadium	0	ND	ND	ND	[8.3]
Zinc	6	202-1660	749	40	320

**Notes:**

(1) Maximum concentration in particular area

a All values expressed in parts per billion (ppb) unless otherwise noted

b Based on total of six samples

c Mean is calculated using zero for samples where parameters not detected

B Analyte found in laboratory blank as well; indicates possible/probable laboratory contamination

J Estimated value

[ ] Positive values less than the contract required detection limit

E Value is estimated due to interference

-- All values show laboratory contamination and statistically treated as zero

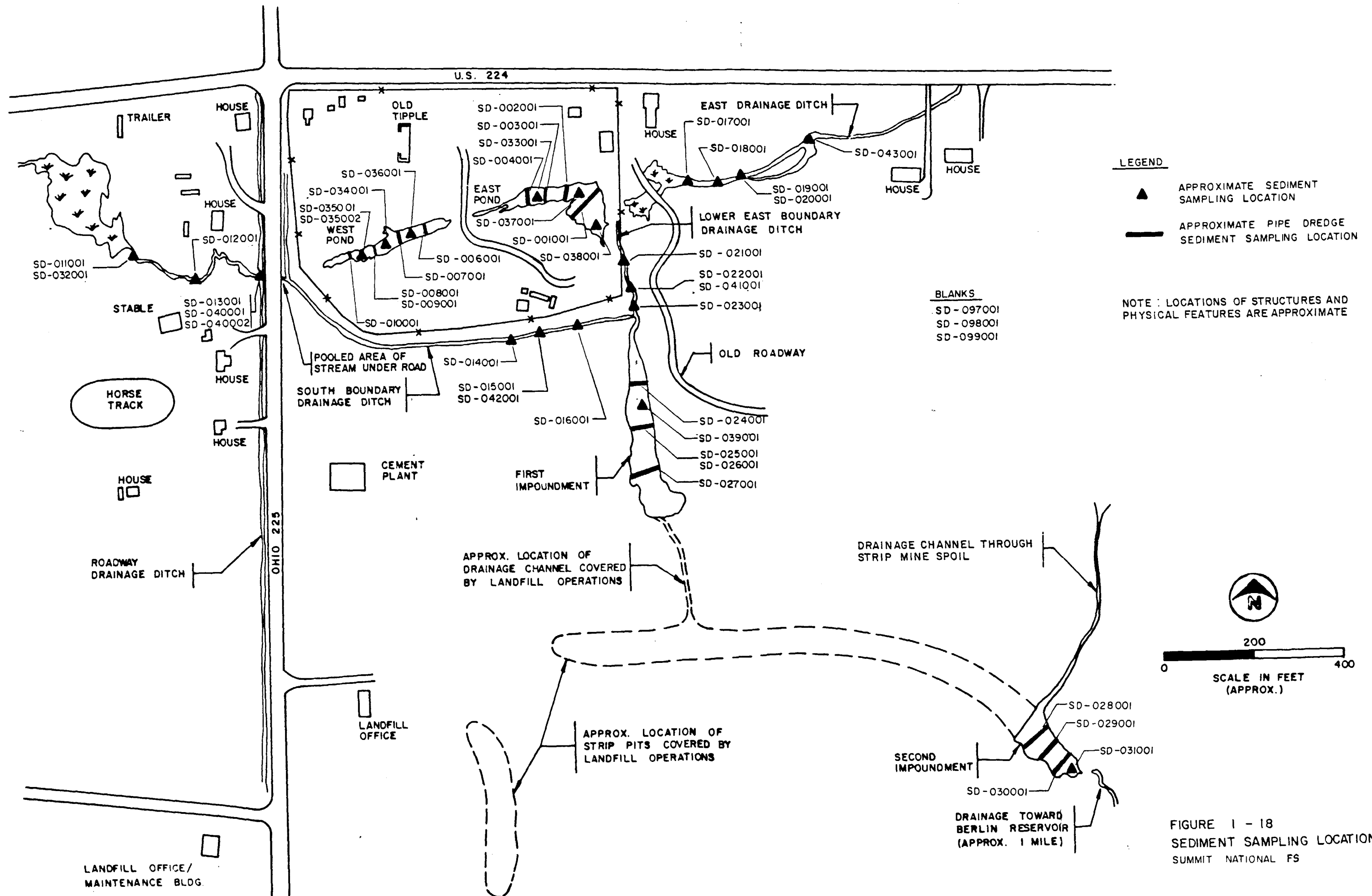
NA Not applicable; only one value

ND Not detected; below background

TABLE 1-5

SUMMARY LIST OF ORGANICS AND INORGANICS IDENTIFIED IN  
WEST POND AND EAST POND SEDIMENT THAT EXCEEDED BACKGROUND SOILS  
SUMMIT NATIONAL FEASIBILITY STUDY

Parameters	West Pond		East Pond		Upper 95% Confidence Limit in Background Soil Samples(2)	Maximum Concentration in Upstream Sediment (2)
	No. of Times Detected(1)	Mean Concentrations(2)(3)	No. of Times Detected(4)	Mean Concentrations(2)(3)		
<b><u>VOLATILES</u></b>						
Methylene Chloride	6	6263	6	314	ND	230
Acetone	2	322	5	180	ND	ND
1,1-Dichloroethene	3	5	3	534	ND	ND
1,1-Dichloroethane	3	10	--	--	ND	ND
Trans-1,2-Dichloroethene	1	1	--	--	ND	ND
1,2-Dichloroethane	1	2426	2	4246	ND	508J
2-Butanone	8	5000	--	--	ND	ND
1,1,1-Trichloroethane	3	670	4	243	ND	ND
Trichloroethene	7	58	2	4	13	ND
Toluene	3	23335	--	--	ND	ND
Benzene	4	--	2	5	ND	ND
Chlorobenzene	--	183	4	95	ND	ND
Ethylbenzene	4	8037	3	35	2	ND
Total Xylenes	6	29023	2	16		
	5					
<b><u>BNA</u></b>						
N-Nitrosodiphenylamine	3	3505	2	2201	ND	409J
Hexachlorobenzene	2	228	2	567	61	518J
Di-n-butylphthalate	2	1319	--	--	86	23488
Bis(2-ethylhexyl)Phthalate	7	70076	9	36707	52	197J
Di-n-Octyl Phthalate	5	11111	3	1933	ND	ND
<b><u>PCBs (5)</u></b>	3	4748	5	6022	ND	ND
<b><u>Inorganic Parameters</u></b>						
Antimony	1	16	2	22	4	ND
Barium	--	--	7	106	100	[128]
Chromium	9	32	7	44	18	10
Copper	9	37	--	--	29	[17]
Cyanide	4	4	2	11	1.186	ND
Iron	9	47789	7	57806	29572	25682
Lead	9	42	7	50	117	20
Mercury	4	.094	4	0.13	0.098	ND
Nickel	9	23	6	24	19	30R
Sodium	4	482	2	547	143	ND
Vanadium	9	24	--	--	26	[24]R
Zinc	9	263	7	471	113	85R,E



Notes:

- (1) Out of total 9 samples
- (2) Units ug/kg dry weight for organics, mg/kg for inorganics
- (3) Mean calculated using zero for samples where parameters not detected
- (4) Out of total 7 samples
- (5) Arochlor 1232, 1242, 1248, 1254
- J Estimated value
- B Found in laboratory blank, indicates possible/probable contamination
- ND Not detected
- A Detected below quantitation limit
- Below background
- [ ] Positive values less than the contract required detection limit
- R Spike sample recovery is not within control limits
- E Estimated due to presence of interference



TABLE 1-6

SUMMARY LIST OF ORGANIC AND INORGANIC PARAMETERS IDENTIFIED  
IN OFFSITE SEDIMENTS THAT EXCEED BACKGROUND (1) (2)  
SUMMIT NATIONAL FEASIBILITY STUDY

Parameters	Concentration in South Ditch Upstream	Concentration in South Ditch Downstream	Concentration in Lower East Drainage Ditch	Upper 95% Confidence Limit in Background Soil Sample (2)	Concentration Background (Upstream) Sediment
<u>VOLATILES</u>					
Methylene Chloride	340	400	278B	ND	230
Acetone	229	ND	ND	ND	ND
Trans-1,2-Dichloroethene	ND	290	ND	ND	ND
1,2-Dichloroethane	ND	ND	240	ND	ND
1,1,1-Trichloroethane	863J	ND	ND	ND	508J
Trichloroethene	ND	110A	ND	ND	ND
Benzene	ND	33A	ND	ND	ND
Toluene	97	ND	ND	13	ND
<u>BNA</u>					
Phenol	558J	ND	ND	ND	ND
1,2-Dichlorobenzene	ND	680A	ND	ND	ND
4-Methylphenol	997J	ND	ND	ND	ND
Naphthalene	1600	800A	ND	1438	ND
2-Methylnaphthalene	630A	1200A	ND	1587	ND
Acenaphthylene	1100A	ND	ND	35	ND
Acenaphthene	1300A	ND	ND	ND	ND
Dibenzofuran	2100A	183J	ND	349	ND
Fluorene	3100	ND	ND	23	ND
N-Nitrosodiphenylamine	809J	ND	ND	ND	409J
Hexachlorobenzene	ND	ND	ND	61	518J
Phenanthrene	6400	710A	ND	1091	ND
Di-N-Butylphthalate	5121J	ND	7336B	86	2348B
Fluoranthene	24000	ND	ND	594	ND
Pyrene	16000	ND	ND	512	ND
Benzo(a)Anthracene	9000	ND	ND	346	ND

Table 1-6  
Page 2

Parameters	Concentration in South Ditch Upstream	Concentration in South Ditch Downstream	Concentration in Lower East Drainage Ditch	Upper 95% Confidence Limit in Background Soil Sample (2)	Concentration Background (Upstream) Sediment
<u>BNA (Cont'd)</u>					
Bis(2-ethylhexyl)Phthalate	704J	15000	26000	52	197J
Chrysene	16000	590A	ND	423	ND
Benzo(b)Fluoranthene	13000	ND	ND	598	ND
Benzo(k)Fluoranthene	413J	ND	ND	598	ND
Benzo(a)Pyrene	7300	ND	ND	301	ND
Indeno(1,2,3-cd)Pyrene	5200	ND	ND	150	ND
Dibenz(a,h)Anthracene	5400	ND	ND	31	ND
Benzo(g,h,i)Perylene	6900	ND	ND	135	ND
<u>PESTICIDES</u>					
Heptachlor Epoxide	ND	ND	ND	ND	ND
PCBs (4)	ND	4200A	ND	ND	ND
<u>Inorganic Parameters</u>					
Aluminum	13800	17600	16700	11694	9560
Antimony	ND	ND	143	4	ND
Arsenic	19	43	38	19	ND
Barium	145	165	--	100	[128]
Cadmium	4.6	14	19	3	ND
Calcium	11800	17236	[10500]	7316	[2855]
Chromium	24	41	55	18	10
Cobalt	[21]	[32]	[20]	13	[18]R
Copper	48	89	74	29	[17]R
Iron	49000	112000	92589	29572	25682
Lead	131	71	35	117	20
Cyanide	ND	2.4	ND	1.186	ND
Magnesium	[3980]	[5000]	--	2782	3247

Table 1-6  
Page 3

Parameters	Concentration in South Ditch Upstream	Concentration in South Ditch Downstream	Concentration in Lower East Drainage Ditch	Upper 95% Confidence Limit in Background Soil Sample (2)	Concentration Background (Upstream) Sediment
<u>INORGANIC PARAMETERS (Cont'd)</u>					
Manganese	855	2810	1500	1003	447R
Mercury	ND	0.15	ND	0.098	ND
Nickel	[36]	51	[49]	19	30R
Potassium	[1950]	[2450]	[2090]	2161	[863]
Sodium	ND	[1780]	[6720]	143	ND
Vanadium	[24]	[36]R	[28]	26	[24]R
Zinc	235	355	1254	113	85R,E

- (1) Maximum concentrations in particular area
- (2) Units ug/kg dry weight
- (3) Based on highest single sample in particular area
- (4) Arochlor 1232, 1242, 1248, 1254
- J Estimated value
- B Found in laboratory blank, indicator possible/probable contamination
- ND Not detected
- A Detected below quantitation limit
- R Spike recovery not within control limits
- [ ] Positive values less than the contract required detection limit
- E Estimated due to presence of interference
- Detected below background

Buried Materials: The buried materials at the site include four buried tanks and an estimated 900 to 1,600 drums. The estimated total number of drums existing intact that may contain waste is 675 to 1,200. The four buried tanks are located in the northwest corner of the site near the scale house. Another tank was located immediately north of the incinerator and was excavated and placed above ground by the TAT team. The drums are located in four separate areas in the southern half of the site south of the onsite ponds.

#### 1.6 FS REPORT ORGANIZATION

This FS report has seven chapters. Chapter 1 is an introduction that gives background information on the Summit National Site. Chapter 2 presents the summary of the baseline public health evaluation. The methodology and results of the initial screening of potential remedial technologies are provided in Chapter 3. Chapter 4 presents the screening of applicable remedial technologies which will be used to assemble alternatives. Chapter 5 describes the development of a limited number of assembled remedial alternatives for detailed evaluation in Chapter 6. Chapter 6 presents the results of the detailed evaluation of the assembled remedial alternatives. Chapter 7 presents the preferred remedial alternative for the Summit National Site.

## CHAPTER 2

### SUMMARY OF THE BASELINE PUBLIC HEALTH EVALUATION

#### 2.1 INTRODUCTION

As part of the remedial investigation (RI) of the Summit National Site a baseline public health evaluation (PHE) was performed to address the potential hazards to public health associated with the site under the no action alternative i.e., in the absence of remedial (corrective) action.

The major sections of the PHE were as follows: first indicator chemicals were selected followed by an exposure assessment, and a toxicity assessment. These latter two sections were then integrated to evaluate risk to human populations potentially exposed to site contaminants. Risk is determined both by comparison to environmental standards or criteria where available and also by quantitative risk estimation.

#### 2.2 SELECTION OF INDICATOR CHEMICALS

As discussed in Chapter 1, the site was a liquid waste incineration facility that operated from 1973 until 1978. Many different types of wastes were reportedly taken to the site. These wastes were incinerated, stored in bulk, or spilled and leaked into site soils. The large number of chemicals detected in each environmental media at the site during the RI required a screening process in which chemicals associated with the greatest potential risk (indicator chemicals) were selected for evaluation in the PHE. This selection process eliminated chemicals from further consideration based on: a comparison of chemicals and concentrations in environmental samples with those detected in blank samples; examination of the frequency with which chemicals were detected; lack of relevant toxicity data; a ranking process outlined in the Superfund Public Health Evaluation Manual (EPA 1986a); and finally for naturally occurring inorganics, comparison with background levels. The indicator chemicals selected for each medium sampled are presented in Table 2-1.

TABLE 2-1

INDICATOR CHEMICALS SELECTED FOR EVALUATION IN THE  
SUMMIT NATIONAL PUBLIC HEALTH EVALUATION  
SUMMIT NATIONAL FEASIBILITY STUDY

Soil

Antimony  
Bis(2-ethylhexyl)phthalate  
Cadmium  
1,2-Dichloroethane  
Hexachlorobenzene  
Phenol  
Polychlorinated biphenyls  
Polynuclear aromatic hydro-  
carbons  
Toluene  
Trichloroethene  
Total xylenes  
Zinc

Groundwater

Acetone  
Barium  
Bis(2-ethylhexyl)phthalate  
Chromium  
Cyanide  
1,1-Dichloroethane  
1,2-Dichloroethane  
1,1-Dichloroethene  
trans-1,2-Dichloroethene  
Ethylbenzene  
Phenol  
Toluene  
Trichloroethene

Sediment

Antimony  
Bis-(2-ethylhexyl)phthalate  
Di-n-butylphthalate  
1,2-Dichloroethane  
Hexachlorobenzene  
Polychlorinated biphenyls  
Polynuclear aromatic hydrocarbons  
Vinyl Chloride  
Zinc

Surface water

Antimony  
Chlorobenzene  
1,1-Dichloroethane  
1,2-Dichloroethane  
Hexachloroethane  
Nickel  
Polynuclear aromatic hydrocarbons  
Tetrachloroethene  
Trichloroethene  
Vinyl Chloride  
Zinc

### 2.3 EXPOSURE ASSESSMENT

Potential pathways of exposure to contaminants originating at the Summit National site under current use of the site and surrounding area are presented in Table 2-2. The pathways considered to have the greatest potential for exposure when all possible exposure pathways are considered, involve dermal absorption and incidental ingestion of contaminants in site soils by trespassers, nearby workers or residents and dermal absorption and incidental ingestion of contaminants in sediment near the site by local residents. Concentrations of indicator chemicals at exposure points (i.e., exposure point concentrations) were determined to evaluate the risks associated with these potential exposures.

Additional exposures through inhalation of volatile contaminants from soil, surface water, or fugitive dust are possible. However, the potential for significant exposure to occur through these pathways is considered to be low in comparison to exposure through direct contact with soils.

In the absence of institutional actions limiting access to, or future uses of the site and surrounding area and no further monitoring or maintenance of the fence (i.e., no action), additional potential exposure pathways are possible. The site is located in an area of mixed land use, and therefore could be reused for a variety of purposes, such as light industry or residential.

These uses could potentially result in exposure to contaminated soil through dermal absorption and incidental ingestion as well as exposure to groundwater through ingestion, inhalation and dermal absorption. Exposure point concentrations were determined for evaluating the risks associated with these potential exposures.

### 2.4 HAZARD ASSESSMENT

A variety of toxic effects have been associated with the indicator chemicals chosen for this assessment. The U. S. EPA and other regulatory agencies have developed chemical specific standards and criteria to protect public health and the environment against these toxic effects. The U. S. EPA recommends that concentrations of contaminants at exposure points be

TABLE 2-2

POTENTIAL PATHWAYS OF EXPOSURE TO CONTAMINANTS ORIGINATING AT THE SUMMIT NATIONAL SITE  
UNDER CURRENT-USE CONDITIONS

Exposure Medium	Potential Routes of Exposure	Potential Receptors	Pathway Complete?	Potential for Significant Exposure
Soil (on site)	Dermal absorption, incidental ingestion	Trespassers	Yes. Although site is fenced, access can be gained near the western border by going under the fence or by climbing over the fence in any location.	Moderate. Surface soils are highly contaminated; however, trespassing may not occur regularly.
Soil (off site southern and eastern perimeters)	Dermal absorption, incidental ingestion	Workers on adjacent properties/nearby residents	Yes. Contaminants have been found in surface soils on adjacent properties.	Moderate.
Air	Inhalation of volatile contaminants from soil or surface water and/or fugitive dust	Trespassers	Yes, if access is gained.	Low. On-site monitoring detected organic vapor concentrations that exceeded background only when the subsurface was disturbed. The potential for dust generation is low given site conditions.
	Inhalation of volatile contaminants from soil or surface water and/or fugitive dust	Workers on adjacent properties/nearby residents	Yes. Contaminants have been found on adjacent properties and/or could be transported off site to adjacent areas.	Minimal. Monitoring downwind of the site did not detect concentrations of vapors greater than background.
Groundwater	Ingestion, inhalation, dermal absorption	Nearby residents/workers using well water	Yes. Although no site-related contaminants have been detected to date in the residential wells sampled. <sup>a</sup>	None currently. Contaminants may migrate to these wells in the future.
Surface water	Dermal absorption, incidental ingestion	Local population	Not known if ditches, ponds, and/or impoundments are used for recreation.	Minimal. Surface water flow is intermittent. No contaminants detected in surface water in areas where exposure most likely occurs (i.e., east of site). Use in other areas unlikely, based on esthetics.
	Ingestion of fish	Local population	Not known if ponds support fish or if people fish in them.	NA. If used, likely to be low.
Sediments	Dermal absorption, incidental ingestion	Local population	Yes, although it is not known if ditches and/or impoundment are used for recreation.	Moderate. Sediment is exposed in dry ditches the majority of the time.

NA = not applicable. Exposure pathway not known to be complete.

<sup>a</sup> Barium has been detected at a concentration of 184 ppb in one residential well. As discussed in Section 5 of the Summit RI Report, this concentration could occur under local natural conditions.



compared to applicable or relevant and appropriate requirements (ARARs) and with other criteria, health advisories, and guidance that may be available (EPA 1986a). ARARs or other suitable criteria are not available for chemical contaminants in soil or sediment. However, several Federal and State ARARs shown in Table 2-3 exist for the chemical contaminants in groundwater at the Summit National site. These Federal ARARs are subject to drinking water standards in Ohio under the state administrative code.

If ARARs are not available for all chemicals and exposures, a quantitative risk assessment is required. Two types of critical toxicity values were selected for use in the quantitative risk assessment. These values, summarized in Table 2-4 include (1) acceptable daily intakes for chronic exposure (AICs) or reference doses (RfDs) and (2) cancer potency factors. The AICs or RfDs, which are similarly derived values, are used to assess the potential noncarcinogenic health risks associated with lifetime (70 years) exposure to chemical contaminants. The cancer potency factors are used to assess cancer risks associated with exposure to potential carcinogens.

## **2.5 RISK ASSESSMENT**

As a first step in the risk assessment that follows, concentrations in environmental media are compared to the Federal ARARs listed in Table 2-3. Both noncarcinogenic and carcinogenic effects are considered in the quantitative risk assessment that is also performed in the absence of ARARs for all indicator chemicals. Evaluation of the noncarcinogenic health risks associated with indicator chemicals is based primarily on a comparison of the estimated daily intake of the indicator chemicals with appropriate critical toxicity values (RfD or AIC) for the protection of human health. For the potential human carcinogens, excess lifetime cancer risks are obtained by multiplying the EPA-derived cancer potency factor by the daily intake of the contaminant under consideration.

In this assessment, the effects of exposure to each of the contaminants under the scenarios evaluated have initially been considered separately. However, it is important to recognize the fact that several of the indicator chemicals occur together in soil and groundwater.

TABLE 2-3

FEDERAL AND STATE STANDARDS AND CRITERIA FOR CHEMICAL CONTAMINANTS IN  
DRINKING WATER  
SUMMIT NATIONAL FEASIBILITY STUDY

Chemical	Primary MCL <sup>a</sup> (ppb)	MCLG <sup>b</sup> (ppb)	Proposed MCLG <sup>b</sup> (ppb)	AWQC <sup>c</sup> (ppb)	Lifetime Health Advisories <sup>d</sup> (ppb)
Acetone	--	--	--	--	--
Barium	1,000	--	1,500	--	1,500 <sup>e</sup>
Bis (2-ethylhexyl) phthalate	--	--	--	21,000	--
Chromium	50	--	120	50(CrVI) 179,000 (CrIII)	120 <sup>e</sup>
Cyanide	--	--	--	200	750
1,1-Dichloroethane	--	--	--	--	--
1,2-Dichloroethane	5	0	--	0(0.94)	--
1,1-Dichloroethene	7	7	--	0(0.033)	70 <sup>e</sup>
t-1,2-Dichloroethene	--	--	70	--	70 <sup>e</sup>
Ethylbenzene	--	--	680	2,400	680 <sup>e</sup>
Phenol	--	--	--	3,500	--
Toluene	--	--	2,000	15,000	2,000 <sup>e</sup>
Trichloroethene	5	0	--	0(2.8)	260

Notes:

Source: Superfund Public Health Evaluation Manual (EPA 1986a).

<sup>a</sup>Primary MCLs (maximum contaminant levels) are standards promulgated under the Safe Drinking Water Act to protect the health of individuals exposed to contaminants in drinking water. MCLs represent the allowable lifetime exposure to a contaminant in drinking water for a 70 kg adult who is assumed to ingest 2 liters of water per day. In addition to health and exposure considerations, MCLs reflect the technological and economic feasibility of removing a contaminant from the water supply.

<sup>b</sup>Final and proposed MCLGs (maximum contaminant level goals) are developed as part of the process for developing final drinking water standards (i.e., MCLs) under the Safe Drinking Water Act. MCLGs are entirely health-based and are always less than or equal to the proposed or final MCLs subsequently developed. Proposed MCLGs can be changed before they are promulgated as final requirements. New Primary MCLs for barium and chromium, based on the proposed MCLGs shown, will eventually replace the existing MCLs shown.

<sup>c</sup>Ambient water quality criteria (AWQC) are estimates of the ambient surface water concentration that will not result in adverse health effects in humans. In the case of potential carcinogens, concentrations associated with a range of incremental cancer risks are provided to supplement a criterion of zero. The value associated with an incremental cancer risk of  $10^{-6}$  is shown in parentheses for the potential carcinogens listed. All values have been adjusted to account for exposure to chemical contaminants only by ingestion of drinking water. These federal criteria are non-enforceable guidelines.

<sup>d</sup>Health advisories are non-enforceable guidelines prepared by EPA's Office of Drinking Water. They have been prepared for various chemicals that may be encountered in a drinking water system and are concentrations of contaminants in drinking water at which adverse effects would not be likely to occur. Health advisories are developed from data describing non-carcinogenic end-points of toxicity. The criteria shown in this table are for lifetime exposure via ingestion of 2 liters of water per day by a 70-kg individual. Relative source contribution factors from drinking water are considered when available.

<sup>e</sup>Assumes a relative contribution factor from drinking water.

TABLE 2-4

CRITICAL TOXICITY VALUES FOR ASSESSMENT OF RISKS  
TO HUMAN HEALTH AS A RESULT OF  
EXPOSURE BY INGESTION  
SUMMIT NATIONAL FEASIBILITY STUDY

Chemical	Noncarcinogenic Effects (mg/kg/day)	Cancer Potency Factors <sup>a</sup> (mg/kg/day) <sup>-1</sup>
Acetone	$1.0 \times 10^{-1}(b)$	NA [D]
Antimony	$4.0 \times 10^{-4}(b)$	NA [D]
Barium	$5.1 \times 10^{-2}(c)$	NA [D]
Bis(2-ethylhexyl) Phthalate	$2.0 \times 10^{-2}(b)$	$6.86 \times 10^{-4}$ [B2]
Cadmium	$5.9 \times 10^{-4}(c)$	NA [D]
Chromium	$1.0$ (CrIII) <sup>b</sup>	NA [D]
	$5.0 \times 10^{-3}$ (CrVI)	NA [D]
Cyanide	$2.0 \times 10^{-2}(b)$	NA [D]
Di-n-butylphthalate	$1.0 \times 10^{-1}(b)$	NA [D]
1,1-Dichloroethane	$1.2 \times 10^{-1}(c)$	NA [D]
1,2-Dichloroethane	--	$9.1 \times 10^{-2}$ [B2]
1,1-Dichloroethene	$9.0 \times 10^{-3}(b)$	$5.8 \times 10^{-1}$ [C]
t-1,2-Dichloroethene	$1.0 \times 10^{-2}(c)$	NA [D]
Ethylbenzene	$0.1^b$	NA [D]
Hexachlorobenzene	--	$1.69$ [B2]
Phenol	$0.1^b$	NA [D]
Polychlorinated Biphenyls	--	$4.34$ [B2]
Polynuclear Aromatic Hydrocarbons	--	$1.15 \times 10^1$ [B2]
Toluene	$3.0 \times 10^{-1}(b)$	NA [D]
Trichloroethene	$7.35 \times 10^{-3}(d)$	$1.1 \times 10^{-2}$ [B2]
Vinyl Chloride	--	$2.3$ [A]
Xylenes	$1.0 \times 10^{-2}(c)$	NA [D]
Zinc	$2.1 \times 10^{-1}(c)$	NA [D]

<sup>a</sup>Upper 95% confidence limit potency factors (EPA 1986a); EPA weight of evidence classifications is shown in brackets and defined in the text.

<sup>b</sup>EPA reference dose (RfD) (EPA 1986b).

<sup>c</sup>Acceptable intake for chronic exposure (AIC) (EPA 1986a).

<sup>d</sup>Risk reference dose (RRPD) (EPA 1985); estimate of daily exposure which appears to be without appreciable risk of deleterious non-carcinogenic effects over a lifetime of exposure.

NA = Not applicable.

Suitable data are not available to characterize the effects of chemical mixtures similar to those present in soil or groundwater in the vicinity of the Summit National site. EPA Guidance (EPA 1986a, 1986c), suggests however, that it also may be useful to sum the excess cancer risks determined for each individual chemical, and to calculate hazard indices, (the sum of the ratios of the environmental concentrations of noncarcinogenic substances to their corresponding relevant criteria) for chemical mixtures. A hazard index of less than 1 indicates that adverse effects on human health are unlikely to result from a given exposure; an index greater than 1 suggests a cause for concern. This approach to assessing risks associated with mixtures of chemicals is based on the assumption that there are no synergistic or antagonistic interactions among the compounds involved and that all compounds have the same toxic end points and mechanisms of action. If these assumptions are incorrect, the actual risk could be under- or overestimated.

#### 2.5.1 Comparison of Environmental Concentrations to ARARs

The available ARARs and other criteria for groundwater exposures noted in Table 2-3 are compared to indicator chemical concentrations in each of the three water bearing units beneath the Summit National Site. Chemicals in groundwater exceeding these criteria are listed in Table 2-5. Since suitable ARARs do not exist for all of the indicator chemicals considered in this risk assessment, a quantitative risk assessment was performed.

#### 2.5.2 Quantitative Risk Assessment

Risks Under Current-Use Conditions: To assess the average exposure to onsite trespassers, or nearby workers or residents to soil contaminants assumptions concerning exposure were made. These included: the ages of the individuals being exposed; the frequency of the exposure; the quantities of soil coming into contact with persons being exposed; and the amount of soil being ingested per exposure. There is considerable uncertainty in quantifying dermal absorption in general, however for the chemicals being evaluated it is considered unlikely that the total intake would increase by more than a factor of 2 if dermal absorption were also considered.

TABLE 2-5  
CHEMICALS IN GROUNDWATER EXCEEDING FEDERAL STANDARDS AND  
CRITERIA FOR DRINKING WATER<sup>a</sup>  
SUMMIT NATIONAL FEASIBILITY STUDY

Water Table		Intermediate Unit	
Average Concentration	Maximum Concentration	Average Concentration	Maximum Concentration
1,2-Dichloroethane	Chromium	1,2-Dichloroethane	Barium
1,1-Dichloroethene	Cyanide	Ethylbenzene	1,2-Dichloroethane
t-1,2-Dichloroethene	1,2-Dichloroethane	Trichloroethene	Ethylbenzene
Trichloroethene	t-1,2-Dichloroethene		Toluene
	Ethylbenzene		Trichloroethene
	Phenol		
	Toluene		
	Trichloroethene		

Notes:

<sup>a</sup> Drinking Water Standards and Criteria are shown in Table 2-3.

Tables 2-6 through 2-11 present exposure estimates and risks for the complete exposure pathways to soil under current use of the site and surrounding area (trespassing teenagers, workers along the southern perimeter and residents along the eastern perimeter). In each of these tables the exposure point concentrations are presented as well as the assumptions used in the calculation of daily intakes under the average and plausible maximum exposure conditions assumed.

For the average exposure to trespassers visiting the Summit National site, the excess cancer risks associated with incidental ingestion of soil at the site are  $10^{-9}$  for exposure to potential carcinogens present either individually or concurrently, as shown on Table 2-6. Under the plausible maximum exposure conditions considered for this scenario, the excess cancer risk is  $3 \times 10^{-5}$  due primarily to exposure to the PCBs present in soil at the site. For noncarcinogenic effects, the estimated intakes by onsite trespassers of the chemicals present in soil under both the average and plausible maximum cases are less than the available criteria for protection against noncarcinogenic effects of the indicator chemicals considered. As shown in Table 2-7, the individual and total hazard indices for these chemicals are less than one. Thus, based on available data, it appears that noncarcinogenic health effects are not likely to result from exposure, either individually or concurrently, to the compounds shown in Table 2-7 for which critical toxicity values are available.

The total excess cancer risks to workers near the Summit National site associated with incidental ingestion of soil during normal work activities exceed  $10^{-6}$  under the plausible maximum, but not the average, exposure conditions evaluated (Table 2-8). Under the plausible maximum exposure conditions, the cancer risk of  $4 \times 10^{-5}$  associated with PAHs is more than an order of magnitude higher than the risks associated with the other potential carcinogens present in these offsite soils. The estimated intakes by offsite workers of the indicator chemicals present in soil under both the average and plausible maximum cases are less than the available criteria for protection against noncarcinogenic effects of the carcinogenic and noncarcinogenic indicator chemicals considered. As shown in Table 2-9, the individual and total hazard indices for these chemicals are less than one. Thus,

TABLE 2-6

EXPOSURE ESTIMATES AND CANCER RISKS FOR TRESPASSING TEENAGERS FROM DIRECT CONTACT WITH SOILS AT THE SUMMIT NATIONAL SITE<sup>a</sup>  
SUMMIT NATIONAL FEASIBILITY STUDY

Chemical	Concentration (ug/kg)		Daily Intake Prorated Over a 70-Year Lifetime <sup>b</sup> (mg/kg/day)		Cancer Risk	
	Geometric					
	Mean	Maximum	Average	Plausible Maximum	Average	Plausible Maximum
Bis (2-ethylhexyl) phthalate	10,000	700,000	$5.2 \times 10^{-9}$	$7.3 \times 10^{-6}$	$4 \times 10^{-12}$	$5 \times 10^{-9}$
1,2-Dichloroethane	1,300	23,000	$6.8 \times 10^{-10}$	$2.4 \times 10^{-7}$	$6 \times 10^{-11}$	$2 \times 10^{-8}$
Hexachlorobenzene	2,100	59,000	$1.1 \times 10^{-9}$	$6.2 \times 10^{-7}$	$2 \times 10^{-9}$	$1 \times 10^{-6}$
PCBs	4,600	590,000	$2.4 \times 10^{-9}$	$6.2 \times 10^{-6}$	$1 \times 10^{-9}$	$3 \times 10^{-5}$
PAHs	400	1,600	$2.1 \times 10^{-10}$	$1.7 \times 10^{-8}$	$2 \times 10^{-9}$	$2 \times 10^{-7}$
Trichloroethene	60	86,000	$3.1 \times 10^{-11}$	$9.0 \times 10^{-7}$	$3 \times 10^{-13}$	$1 \times 10^{-8}$
				Total risk	$1 \times 10^{-8}$	$3 \times 10^{-5}$

**Notes:**

<sup>a</sup> Cancer potency factors used to calculate cancer risks are shown in Table 2-4. For this analysis, the average daily dose received over the assumed exposure period was prorated over a 70-year lifetime, and the lifetime risk was calculated accordingly. This procedure is recommended in EPA's "Guidelines for Carcinogen Risk Assessment" (EPA 1986d).

<sup>b</sup> Daily intake =  $\frac{(\text{Conc. soil mg/kg})(20 \text{ mg/visit})(6 \text{ visits/year})(5 \text{ years})(\text{Kg}/10^6 \text{ mg})}{(45 \text{ kg})(70 \text{ years})(365 \text{ days/year})}$  = (Conc. Soil mg/kg)( $5.22 \times 10^{-10}$  Kg soil/Kg body weight/day) under average exposure conditions (mg/kg/day)

Where Conc. Soil = Geometric mean.

Daily intake under =  $\frac{(\text{Conc. Soil mg/kg})(100 \text{ mg/visit})(24 \text{ visits/year})(5 \text{ years})(\text{Kg}/10^6 \text{ mg})}{(45 \text{ kg})(70 \text{ years})(365 \text{ days/year})}$  = (Conc. Soil mg/kg)( $1.04 \times 10^{-8}$  Kg soil/Kg body weight/day) plausible maximum exposure conditions (mg/kg/day)

Where Conc. Soil = Maximum concentration.



TABLE 2-7

EXPOSURE ESTIMATES AND NONCARCINOGENIC RISKS FOR TRESPASSING TEENAGERS FROM DIRECT CONTACT WITH SOILS AT THE SUMMIT NATIONAL SITE<sup>a</sup>  
SUMMIT NATIONAL FEASIBILITY STUDY

Chemical	Concentration (ug/kg)		Chronic Daily Intake (CDI) <sup>b</sup> (mg/kg/day)		Hazard Index (CDI/RfD)	
	Geometric Mean	Maximum	Average	Plausible Maximum	Average	Plausible Maximum
Antimony	61,000	545,000	$4.5 \times 10^{-7}$	$8.0 \times 10^{-5}$	$1 \times 10^{-3}$	$2 \times 10^{-1}$
Bis (2-ethylhexyl) Phthalate	10,000	700,000	$7.3 \times 10^{-8}$	$1.0 \times 10^{-4}$	$4 \times 10^{-6}$	$5 \times 10^{-3}$
Cadmium	5,000	112,000	$3.7 \times 10^{-8}$	$1.6 \times 10^{-5}$	$7 \times 10^{-7}$	$3 \times 10^{-2}$
Phenol	2,100	44,000	$1.5 \times 10^{-8}$	$6.4 \times 10^{-6}$	$2 \times 10^{-9}$	$6 \times 10^{-5}$
Toluene	56	260,000	$4.1 \times 10^{-10}$	$3.8 \times 10^{-5}$	$1 \times 10^{-8}$	$1 \times 10^{-4}$
Trichloroethene	60	86,000	$4.4 \times 10^{-10}$	$1.3 \times 10^{-5}$	$6 \times 10^{-8}$	$2 \times 10^{-3}$
Xylenes	76	210,000	$5.6 \times 10^{-10}$	$3.1 \times 10^{-5}$	$6 \times 10^{-8}$	$3 \times 10^{-3}$
Zinc	120,000	643,000	$8.8 \times 10^{-7}$	$9.4 \times 10^{-5}$	$4 \times 10^{-6}$	$4 \times 10^{-4}$
Total Hazard Index					$1 \times 10^{-3}$	$3 \times 10^{-1}$

**Notes:**

<sup>a</sup> Reference doses (RfDs) used to calculate hazard indices are shown in Table 2-4.

<sup>b</sup> Daily intake =  $\frac{(\text{Conc. soil mg/kg})(20 \text{ mg/visit})(6 \text{ visits/year})(5 \text{ years})(\text{Kg}/10^6 \text{ mg})}{(45 \text{ kg})(365 \text{ days/year})(5 \text{ years})}$  = (Conc. Soil mg/kg)( $7.31 \times 10^{-9}$  Kg soil/Kg body weight/day) under average exposure conditions (mg/kg/day)

Where Conc. Soil = Geometric mean.

Daily intake under =  $\frac{(\text{Conc. Soil mg/kg})(100 \text{ mg/visit})(24 \text{ visits/year})(5 \text{ years})(\text{Kg}/10^6 \text{ mg})}{(45 \text{ kg})(365 \text{ days/year})(5 \text{ years})}$  = (Conc. Soil mg/kg)( $1.46 \times 10^{-7}$  Kg soil/Kg body weight/day) plausible maximum exposure conditions (mg/kg/day)

Where Conc. Soil = Maximum Concentration.

TABLE 2-8

EXPOSURE ESTIMATES AND CANCER RISKS FOR WORKERS FROM DIRECT CONTACT WITH SOILS NEAR THE SUMMIT NATIONAL SITE<sup>a</sup>  
SUMMIT NATIONAL FEASIBILITY STUDY

Chemical	Concentration (ug/kg)		Daily Intake Prorated Over a 70-Year Lifetime <sup>b</sup> (mg/kg/day)		Cancer Risk	
	Geometric					
	Mean	Maximum	Average	Plausible Maximum	Average	Plausible
Bis (2-ethylhexyl) phthalate	390	470	$7.0 \times 10^{-9}$	$8.4 \times 10^{-8}$	$5 \times 10^{-12}$	$6 \times 10^{-11}$
1,2-Dichloroethane	8	16	$1.4 \times 10^{-10}$	$2.9 \times 10^{-9}$	$1 \times 10^{-11}$	$3 \times 10^{-10}$
PCBs	3,000	3,100	$5.4 \times 10^{-8}$	$5.5 \times 10^{-7}$	$2 \times 10^{-7}$	$2 \times 10^{-6}$
PAHs	2,000	21,000	$3.6 \times 10^{-8}$	$3.8 \times 10^{-6}$	$4 \times 10^{-7}$	$4 \times 10^{-5}$
Total risk					$6 \times 10^{-7}$	$4 \times 10^{-5}$

**Notes:**

<sup>a</sup> Cancer Potency factors used to calculate cancer risks are shown in Table 2-4. For this analysis, the average daily dose received over the assumed exposure period was prorated over a 70-year lifetime, and the lifetime risk was calculated accordingly. This procedure is recommended in EPA's "Guidelines for Carcinogen Risk Assessment" (EPA 1986d).

<sup>b</sup> Daily intake =  $\frac{(\text{Conc. soil mg/kg})(20 \text{ mg/visit})(160 \text{ visits/year})(10 \text{ years})(\text{Kg}/10^6 \text{ mg})}{(70 \text{ kg})(70 \text{ years})(365 \text{ days/year})}$  = (Conc. Soil mg/kg)( $1.79 \times 10^{-8}$  Kg soil/Kg body weight/day) under average exposure conditions (mg/kg/day)

Where Conc. Soil = Geometric mean.

Daily intake under =  $\frac{(\text{Conc. Soil mg/kg})(100 \text{ mg/visit})(160 \text{ visits/year})(20 \text{ years})(\text{Kg}/10^6 \text{ mg})}{(70 \text{ kg})(70 \text{ years})(365 \text{ days/year})}$  = (Conc. Soil mg/kg)( $1.79 \times 10^{-7}$  Kg soil/Kg body weight/day) plausible maximum exposure conditions (mg/kg/day)

Where Conc. Soil = Maximum concentration

TABLE 2-9

EXPOSURE ESTIMATES AND NONCARCINOGENIC RISKS FOR WORKERS FROM DIRECT CONTACT WITH SOILS NEAR THE SUMMIT NATIONAL SITE<sup>a</sup>  
SUMMIT NATIONAL FEASIBILITY STUDY

Chemical	Concentration (ug/kg)		Chronic Daily Intake (CDI) <sup>b</sup> (mg/kg/day)		Hazard Index (CDI/RfD)	
	Geometric Mean	Maximum	Average	Plausible Maximum	Average	Plausible Maximum
Bis (2-ethylhexyl) Phthalate	390	470	$4.9 \times 10^{-8}$	$2.9 \times 10^{-7}$	$2 \times 10^{-6}$	$1 \times 10^{-5}$
Toluene	4	4	$5.0 \times 10^{-10}$	$2.5 \times 10^{-9}$	$2 \times 10^{-9}$	$8 \times 10^{-9}$
Zinc	85,000	135,000	$1.1 \times 10^{-5}$	$8.4 \times 10^{-5}$	$5 \times 10^{-5}$	$4 \times 10^{-4}$
Total Hazard Index					$5 \times 10^{-5}$	$4 \times 10^{-4}$

Notes:

<sup>a</sup> Reference doses (RfDs) used to calculate hazard indices are shown in Table 2-4.

<sup>b</sup> Daily intake =  $\frac{(\text{Conc. soil mg/kg})(20 \text{ mg/visit})(160 \text{ visits/year})(10 \text{ years})(\text{Kg}/10^6 \text{ mg})}{(70 \text{ kg})(10 \text{ years})(365 \text{ days/year})}$  = (Conc. Soil mg/kg)( $1.25 \times 10^{-7}$  Kg soil/Kg body weight/day) under average exposure conditions (mg/kg/day)

Where Conc. Soil = Geometric mean

Daily intake under =  $\frac{(\text{Conc. Soil mg/kg})(100 \text{ mg/visit})(160 \text{ visits/year})(20 \text{ years})(\text{Kg}/10^6 \text{ mg})}{(70 \text{ kg})(20 \text{ years})(365 \text{ days/year})}$  = (Conc. Soil mg/kg)( $6.27 \times 10^{-7}$  Kg soil/Kg body weight/day) plausible maximum exposure conditions (mg/kg/day)

Where Conc. Soil = Maximum concentration

TABLE 2-10

EXPOSURE ESTIMATES AND CANCER RISKS FOR RESIDENTIAL EXPOSURE TO CHEMICALS IN SOIL NEAR THE EASTERN PERIMETER OF THE SUMMIT NATIONAL SITE<sup>a</sup>  
SUMMIT NATIONAL FEASIBILITY STUDY

Chemical	Concentration (ug/kg)		Daily Intake Prorated Over a 70-Year Lifetime <sup>b</sup> (mg/kg/day)		Cancer Risk	
	Average	Maximum	Average	Plausible Maximum	Average	Plausible Maximum
Bis (2-ethylhexyl) phthalate	110	206	$4.4 \times 10^{-8}$	$4.2 \times 10^{-7}$	$3 \times 10^{-11}$	$3 \times 10^{-10}$
PCBs	490	540	$2.0 \times 10^{-7}$	$1.1 \times 10^{-6}$	$9 \times 10^{-7}$	$5 \times 10^{-6}$
PAHs	400	7,100	$1.6 \times 10^{-7}$	$1.4 \times 10^{-5}$	$2 \times 10^{-6}$	$2 \times 10^{-4}$
Total risk					$3 \times 10^{-6}$	$2 \times 10^{-4}$

## Notes:

<sup>a</sup> Cancer potency factors used to calculate cancer risks are shown in Table 2-4. For this analysis, the average daily dose received over the assumed exposure period was prorated over a 70-year lifetime, and the lifetime risk was calculated accordingly. This procedure is recommended in EPA's "Guidelines for Carcinogen Risk Assessment" (EPA 1986d).

<sup>b</sup> Daily intake =  $\frac{(\text{Conc. soil mg/kg})(0.92 \text{ mg/kg-visit})(160 \text{ visits/year})(70 \text{ years})(\text{Kg}/10^6 \text{ mg})}{\text{body weight/day}}$  = (Conc. Soil mg/kg)( $4.03 \times 10^{-7}$  Kg soil/Kg body weight/day)  
under average exposure conditions (70 years)(365 days/year)  
(mg/kg/day)

Where Conc. Soil = Geometric mean

Daily intake under-plausible maximum =  $\frac{(\text{Conc. Soil mg/kg})(4.6 \text{ mg/kg-visit})(160 \text{ visit/year})(70 \text{ years})(\text{Kg}/10^6 \text{ mg})}{\text{weight/day}}$  = (Conc. Soil mg/kg)( $2.02 \times 10^{-6}$  Kg soil/Kg body weight/day)  
plausible maximum exposure conditions (70 years)(365 days/year)  
(mg/kg/day)

Where Conc. Soil = Maximum concentration

TABLE 2-11

EXPOSURE ESTIMATES AND NONCARCINOGENIC RISKS FOR RESIDENTIAL EXPOSURE TO CHEMICALS IN SOIL NEAR THE EASTERN PERIMETER OF THE  
SUMMIT NATIONAL SITE<sup>a</sup>

Chemical	Concentration (ug/kg)		Chronic Daily Intake (CDI) <sup>b</sup> (mg/kg/day)		Hazard Index (CDI/RfD)	
	Average	Maximum	Average	Plausible Maximum	Average	Plausible Maximum
Bis (2-ethylhexyl) Phthalate	110	206	$4.4 \times 10^{-8}$	$4.2 \times 10^{-7}$	$2 \times 10^{-6}$	$2 \times 10^{-5}$
Cadmium	3,400	4,200	$1.4 \times 10^{-6}$	$8.5 \times 10^{-6}$	$2 \times 10^{-3}$	$1 \times 10^{-2}$
Toluene	12	28	$4.8 \times 10^{-5}$	$5.7 \times 10^{-4}$	$2 \times 10^{-8}$	$2 \times 10^{-7}$
Zinc	120,000	380,000	$4.8 \times 10^{-5}$	$7.7 \times 10^{-4}$	$2 \times 10^{-4}$	$4 \times 10^{-3}$
Total Hazard Index					$2 \times 10^{-3}$	$1 \times 10^{-2}$

Notes:

<sup>a</sup> Reference doses (RfDs) used to calculate hazard indices are shown in Table 2-4.

<sup>b</sup> Daily intake =  $\frac{(\text{Conc. soil mg/kg})(0.92 \text{ mg/kg-visit})(160 \text{ visits/year})(70 \text{ years})(\text{Kg}/10^6 \text{ mg})}{\text{weight/day}}$  = (Conc. Soil mg/kg)( $4.03 \times 10^{-7}$  Kg soil/Kg body weight/day)  
under average exposure conditions (70 years)(365 days/year)  
(mg/kg/day)

Where Conc. Soil = Geometric mean

Daily intake under =  $\frac{(\text{Conc. Soil mg/kg})(4.6 \text{ mg/kg-visit})(160 \text{ visit/year})(70 \text{ years})(\text{Kg}/10^6 \text{ mg})}{\text{weight/day}}$  = (Conc. Soil mg/kg)( $2.02 \times 10^{-6}$  Kg soil/Kg body weight/day)  
plausible maximum exposure conditions (70 years)(365 days/year)  
(mg/kg/day)

Where Conc. Soil = Maximum concentration

based on available data, it appears that noncarcinogenic health effects are not likely to result from exposure to the compounds shown in Table 2-9 for which critical toxicity values are available.

The potential excess lifetime cancer risks to residents along the eastern perimeter of the site from direct contact with soil are shown in Table 2-10. The total excess cancer risks associated with incidental ingestion of soil exceeds  $10^{-6}$  for both the average and plausible maximum exposure conditions evaluated. Under the plausible maximum exposure conditions, the cancer risk of  $2 \times 10^{-4}$  associated with exposure to PAHs is at least an order of magnitude higher than the risks associated with the other potential carcinogens that may be present in soils in this offsite residential area along the eastern perimeter. The estimated intakes by residents of the indicator chemicals present in soil under both the average and plausible maximum cases are less than the available criteria for protection against noncarcinogenic effects of the carcinogenic and noncarcinogenic indicator chemicals considered. As shown in Table 2-11, the individual and total hazard indices for these chemicals are less than one. Thus, based on available data, it appears that noncarcinogenic health effects are not likely to result from exposure to the compounds shown in Table 2-11 for which critical toxicity values are available.

To assess the potential exposure to sediments near the site, it was assumed that children would have contact with sediment in the lower east, east and south ditches, and the first impoundment, and that teenagers would have contact with sediment in the second impoundment (assuming it is dry during periods in the future). Exposure occurring through incidental ingestion was quantified. Tables 2-12 through 2-15 present exposure assumptions, exposure point concentrations, daily intakes, and risks for these two complete exposure pathways to sediment under current use of the site.

The potential excess lifetime cancer risks to children playing in ditches near the site (lower east, east and south and first impoundment) from direct contact with sediment are shown in Table 2-12. The total excess cancer risks associated with incidental ingestion of sediment are less than  $10^{-6}$  for the average exposure scenario but exceed  $10^{-6}$  for the plausible maximum

TABLE 2-12

EXPOSURE ESTIMATES AND CANCER RISKS FOR CHILDREN FROM DIRECT CONTACT WITH SEDIMENT IN DITCHES AND FIRST IMPOUNDMENT NEAR THE SUMMIT NATIONAL SITE<sup>a</sup>

Chemical	Concentration (ug/kg)		Daily Intake Prorated Over a 70-Year Lifetime <sup>b</sup> (mg/kg/day)		Cancer Risk	
	Geometric Mean	Maximum	Average	Plausible Maximum	Average	Plausible Maximum
Bis (2-ethylhexyl) Phthalate	3,800	26,000	$7.5 \times 10^{-8}$	$5.1 \times 10^{-6}$	$5 \times 10^{-11}$	$4 \times 10^{-9}$
1,2-Dichloroethane	172	240	$3.4 \times 10^{-8}$	$4.7 \times 10^{-8}$	$3 \times 10^{-10}$	$4 \times 10^{-9}$
PCBs	1,100	4,200	$2.2 \times 10^{-8}$	$8.3 \times 10^{-7}$	$1 \times 10^{-7}$	$4 \times 10^{-6}$
PAHs	580	1,080	$1.1 \times 10^{-8}$	$2.1 \times 10^{-7}$	$1 \times 10^{-7}$	$2 \times 10^{-6}$
Total risk					$2 \times 10^{-7}$	$6 \times 10^{-6}$

<sup>a</sup>Cancer potency factors used to calculate cancer risks are shown in Table 2-4. For this analysis, the average daily dose received over the assumed exposure period was prorated over a 70-year lifetime, and the lifetime risk was calculated accordingly. This procedure is recommended in EPA's "Guidelines for Carcinogen Risk Assessment" (EPA 1986d).

<sup>b</sup>Daily intake under average =  $\frac{(\text{Conc. soil mg/kg})(100 \text{ mg/visit})(32 \text{ visits/year})(3 \text{ years})(\text{kg}/10^6 \text{ mg})}{(19 \text{ kg})(70 \text{ years})(365 \text{ days/year})}$  = (Conc. soil mg/kg)( $1.98 \times 10^{-8}$  kg soil/kg body weight/day)

where: Conc. soil = geometric mean.

Daily intake under plausible maximum exposure conditions =  $\frac{(\text{Conc. soil mg/kg})(500 \text{ mg/visit})(64 \text{ visits/year})(3 \text{ years})(\text{kg}/10^6 \text{ mg})}{(19 \text{ kg})(70 \text{ years})(365 \text{ days/year})}$  = (Conc. soil mg/kg)( $1.98 \times 10^{-7}$  kg soil/kg body weight/day)

where: Conc. soil = maximum concentration.

TABLE 2-13

EXPOSURE ESTIMATES AND NONCARCINOGENIC RISKS FOR CHILDREN  
FROM DIRECT CONTACT WITH SEDIMENT IN DITCHES AND FIRST IMPOUNDMENT AND FIRST IMPOUNDMENT NEAR  
SUMMIT NATIONAL SITE<sup>a</sup>

Chemical	Concentration (ug/kg)		Chronic Daily Intake (CDI) <sup>b</sup> (mg/kg/day)		Hazard Index (CDI/RfD)	
	Geometric Mean	Maximum	Average	Plausible Maximum	Average	Plausible Maximum
Antimony	86,000	143,000	$4.0 \times 10^{-5}$	$6.6 \times 10^{-4}$	$1 \times 10^{-1}$	2
Bis (2-ethylhexyl) Phthalate	3,800	26,000	$1.8 \times 10^{-6}$	$1.2 \times 10^{-4}$	$9 \times 10^{-5}$	$6 \times 10^{-3}$
Di-n-butylphthalate	5,200	8,600	$2.4 \times 10^{-6}$	$4.0 \times 10^{-5}$	$2 \times 10^{-5}$	$4 \times 10^{-4}$
Zinc	200,000	1,070,000	$9.2 \times 10^{-5}$	$4.9 \times 10^{-3}$	$4 \times 10^{-4}$	$2 \times 10^{-2}$
Total Hazard Index					$1 \times 10^{-1}$	2

<sup>a</sup>Reference does (RfDs) used to calculate hazard indices are shown in Table 2-4.

<sup>b</sup>Daily intake under average exposure conditions (mg/kg/day) =  $\frac{(\text{Conc. soil mg/kg})(100 \text{ mg/visit})(32 \text{ visits/year})(3 \text{ years})(\text{kg}/10^6 \text{ mg})}{(19 \text{ kg})(3 \text{ years})(365 \text{ days/year})}$  = (Conc. soil mg/kg)( $4.61 \times 10^{-7}$  kg soil/kg body weight/day)

where: Conc. soil = geometric mean.

Daily intake under plausible maximum exposure conditions (mg/kg/day) =  $\frac{(\text{Conc. soil mg/kg})(500 \text{ mg/visit})(64 \text{ visits/year})(3 \text{ years})(\text{kg}/10^6 \text{ mg})}{(19 \text{ kg})(3 \text{ years})(365 \text{ days/year})}$  = (Conc. soil mg/kg)( $4.61 \times 10^{-6}$  kg soil/kg body weight/day)

where: Conc. soil = maximum concentration.



TABLE 2-14

EXPOSURE ESTIMATES AND CANCER RISKS FOR TEENAGERS FROM DIRECT CONTACT WITH SEDIMENT  
IN THE SECOND IMPOUNDMENT<sup>a</sup>

Chemical	Concentration (ug/kg)		Daily Intake Prorated Over a 70-Year Lifetime <sup>b</sup> (mg/kg/day)		Cancer Risk	
	Geometric Mean	Maximum	Average	Plausible Maximum	Average	Plausible Maximum
Bis (2-ethylhexyl) Phthalate	2,900	24,000	$8.1 \times 10^{-9}$	$6.7 \times 10^{-7}$	$6 \times 10^{-12}$	$5 \times 10^{-10}$
Hexachlorobenzene	NA	2,800	NA	$7.8 \times 10^{-8}$	NA	$1 \times 10^{-7}$
Total risk					$6 \times 10^{-12}$	$1 \times 10^{-7}$

<sup>a</sup>Cancer potency factors used to calculate cancer risks are shown in Table 2-4. For this analysis, the average daily dose received over the assumed exposure period was prorated over a 70-year lifetime, and the lifetime risk was calculated accordingly. This procedure is recommended in EPA's "Guidelines for Carcinogen Risk Assessment" (EPA 1986d).

<sup>b</sup>Daily intake under average =  $\frac{(\text{Conc. soil mg/kg})(20 \text{ mg/visit})(32 \text{ visits/year})(5 \text{ years})(\text{kg}/10^6 \text{ mg})}{(45 \text{ kg})(70 \text{ years})(365 \text{ days/year})}$  = (Conc. soil mg/kg)( $2.78 \times 10^{-9}$  kg soil/kg body weight/day) exposure conditions (mg/kg/day)

where: Conc. soil = geometric mean.

Daily intake under plausible maximum =  $\frac{(\text{Conc. soil mg/kg})(100 \text{ mg/visit})(64 \text{ visits/year})(5 \text{ years})(\text{kg}/10^6 \text{ mg})}{(45 \text{ kg})(70 \text{ years})(365 \text{ days/year})}$  = (Conc. soil mg/kg)( $2.78 \times 10^{-8}$  kg soil/kg body weight/day) exposure conditions (mg/kg/day)

where: Conc. soil = maximum concentration.

NA = not applicable, only detected in one sample.

TABLE 2-15

EXPOSURE ESTIMATES AND NONCARCINOGENIC RISKS FOR TEENAGERS FROM DIRECT CONTACT WITH SEDIMENT IN THE SECOND IMPOUNDMENT<sup>a</sup>

Chemical	Concentration (ug/kg)		Chronic Daily Intake (CDI) <sup>b</sup> (mg/kg/day)		Hazard Index (CDI/RfD)	
	Geometric Mean	Maximum	Average	Plausible Maximum	Average	Plausible Maximum
Bis (2-ethylhexyl) Phthalate	2,900	24,000	$1.1 \times 10^{-7}$	$9.3 \times 10^{-6}$	$6 \times 10^{-6}$	$5 \times 10^{-4}$
Di-n-butylphthalate	NA	4,300	NA	$1.7 \times 10^{-6}$	NA	$2 \times 10^{-5}$
Zinc	110,000	200,000	$4.3 \times 10^{-6}$	$7.8 \times 10^{-5}$	$2 \times 10^{-5}$	$4 \times 10^{-4}$
Total Hazard Index					$3 \times 10^{-5}$	$9 \times 10^{-4}$

<sup>a</sup>Reference doses (RfDs) used to calculate hazard indices are shown in Table 2-4.

<sup>b</sup>Daily intake

under average exposure conditions (mg/kg/day) =  $\frac{(\text{Conc. soil mg/kg})(20 \text{ mg/visit})(32 \text{ visits/year})(5 \text{ years})(\text{kg}/10^6 \text{ mg})}{(45 \text{ kg})(5 \text{ years})(365 \text{ days/year})} = (\text{Conc. soil mg/kg})(3.90 \times 10^{-8} \text{ kg soil/kg body weight/day})$

where: Conc. soil = geometric mean.

Daily intake

under plausible maximum exposure conditions (mg/kg/day) =  $\frac{(\text{Conc. soil mg/kg})(100 \text{ mg/visit})(64 \text{ visits/year})(5 \text{ years})(\text{kg}/10^6 \text{ mg})}{(45 \text{ kg})(5 \text{ years})(365 \text{ days/year})} = (\text{Conc. soil mg/kg})(3.90 \times 10^{-7} \text{ kg soil/kg body weight/day})$

where: Conc. soil = maximum concentration.

NA = not applicable. Only detected in one sample.

exposure scenario. Under the plausible maximum exposure scenario the potential excess lifetime cancer risks associated with both PCBs and PAHs exceed  $10^{-6}$ . As shown in Table 2-13, under the average exposure scenario, the estimated intakes by children of the indicator chemicals present in sediment in the ditches are less than the available criteria for protection against noncarcinogenic effects of the chemicals considered. Thus, based on available data, it appears that under the average exposure scenario considered, noncarcinogenic health effects are not likely to result from exposure to the compounds shown in Table 2-13 for which critical toxicity values are available. However, under the plausible maximum exposure scenario considered, the estimated intake of antimony exceeds the available criteria for protection against noncarcinogenic effects. Consequently the total hazard index for exposure under the plausible maximum exposure conditions exceeds one.

The potential excess lifetime cancer risks to teenagers exposed to sediment in the second impoundment through incidental ingestion are shown in Table 2-14. The total excess cancer risks associated with both the average and plausible maximum exposure scenarios are less than  $10^{-6}$ .

The estimated intakes by teenagers of the indicator chemicals present in sediment in the second impoundment under both the average and plausible maximum cases are less than the available criteria for protection against noncarcinogenic effects of the indicator chemicals considered. As shown in Table 2-15 the individual and total hazard indices for these chemicals are less than one. Thus, based on the available data, it appears that noncarcinogenic health effects are not likely to result from exposure to the compounds shown in Table 2-15 for which critical toxicity values are available.

Risks Under Future-Use Conditions: Tables 2-16 through 2-20 present exposure estimates and risks to workers assuming the site is reused in the future for light industry. These estimates are followed by evaluation of risks to residents at the Summit National Site assuming the site is reused in the future for residential dwellings.

TABLE 2-16

EXPOSURE ESTIMATES AND CANCER RISKS FOR WORKERS FROM DIRECT CONTACT WITH SOILS AT THE SUMMIT NATIONAL SITE<sup>a</sup>  
SUMMIT NATIONAL FEASIBILITY STUDY

Chemical	Concentration (ug/kg)		Daily Intake Prorated Over a 70-Year Lifetime <sup>b</sup> (mg/kg/day)		Cancer Risk	
	Geometric Mean	Maximum	Average	Plausible Maximum	Average	Plausible Maximum
Bis (2-ethylhexyl) phthalate	10,000	700,000	$1.8 \times 10^{-7}$	$1.3 \times 10^{-4}$	$1 \times 10^{-10}$	$9 \times 10^{-8}$
1,2-Dichloroethane	1,300	23,000	$2.3 \times 10^{-8}$	$4.1 \times 10^{-6}$	$2 \times 10^{-9}$	$4 \times 10^{-7}$
Hexachlorobenzene	2,100	59,000	$3.8 \times 10^{-8}$	$1.1 \times 10^{-5}$	$6 \times 10^{-8}$	$2 \times 10^{-5}$
PCBs	4,600	590,000	$2.9 \times 10^{-8}$	$5.3 \times 10^{-7}$	$1 \times 10^{-7}$	$2 \times 10^{-4}$
PAHs	400	1,600	$2.5 \times 10^{-9}$	$1.4 \times 10^{-5}$	$3 \times 10^{-8}$	$2 \times 10^{-6}$
Trichloroethene	60	86,000	$1.1 \times 10^{-9}$	$1.5 \times 10^{-5}$	$1 \times 10^{-11}$	$2 \times 10^{-7}$
Total risk					$2 \times 10^{-7}$	$2 \times 10^{-4}$

**Notes:**

<sup>a</sup> Cancer potency factors used to calculate cancer risks are shown in Table 2-4. For this analysis, the average daily dose received over the assumed exposure period was prorated over a 70-year lifetime, and the lifetime risk was calculated accordingly. This procedure is recommended in EPA's "Guidelines for Carcinogen Risk Assessment" (EPA 1986d).

<sup>b</sup> Daily intake =  $\frac{(\text{Conc. soil mg/kg})(20 \text{ mg/visit})(160 \text{ visits/year})(10 \text{ years})(\text{Kg}/10^6 \text{ mg})}{(70 \text{ kg})(70 \text{ years})(365 \text{ days/year})}$  = (Conc. Soil mg/kg)( $1.79 \times 10^{-8}$  Kg soil/Kg body weight/day) under average exposure conditions (mg/kg/day)

Where Conc. Soil = Geometric mean

Daily intake under =  $\frac{(\text{Conc. Soil mg/kg})(100 \text{ mg/visit})(160 \text{ visit/year})(20 \text{ years})(\text{Kg}/10^6 \text{ mg})}{(70 \text{ kg})(70 \text{ years})(365 \text{ days/year})}$  = (Conc. Soil mg/kg)( $1.79 \times 10^{-7}$  Kg soil/Kg body weight/day) plausible maximum exposure conditions (mg/kg/day)

Where conc. Soil = Maximum concentration

TABLE 2-17

EXPOSURE ESTIMATES AND NONCARCINOGENIC RISKS FOR WORKERS FROM DIRECT CONTACT WITH SOILS AT THE SUMMIT NATIONAL SITE<sup>a</sup>  
SUMMIT NATIONAL FEASIBILITY STUDY

Chemical	Concentration (ug/kg)		Chronic Daily Intake (CDI) <sup>b</sup> (mg/kg/day)		Hazard Index (CDI/RfD)	
	Geometric Mean	Maximum	Average	Plausible Maximum	Average	Plausible Maximum
Antimony	61,000	545,000	$7.6 \times 10^{-6}$	$3.4 \times 10^{-4}$	$2 \times 10^{-2}$	$8 \times 10^{-1}$
Bis (2-ethylhexyl) Phthalate	10,000	700,000	$1.3 \times 10^{-6}$	$4.4 \times 10^{-4}$	$6 \times 10^{-5}$	$2 \times 10^{-2}$
Cadmium	5,000	112,000	$6.3 \times 10^{-7}$	$7.0 \times 10^{-5}$	$1 \times 10^{-3}$	$1 \times 10^{-1}$
Phenol	2,100	44,000	$2.6 \times 10^{-9}$	$2.8 \times 10^{-4}$	$3 \times 10^{-6}$	$3 \times 10^{-4}$
Toluene	56	260,000	$7.0 \times 10^{-9}$	$1.6 \times 10^{-4}$	$2 \times 10^{-8}$	$5 \times 10^{-4}$
Trichloroethene	60	86,000	$7.5 \times 10^{-9}$	$5.4 \times 10^{-4}$	$1 \times 10^{-6}$	$7 \times 10^{-3}$
Total Xylenes	76	210,000	$9.5 \times 10^{-9}$	$1.3 \times 10^{-4}$	$1 \times 10^{-6}$	$1 \times 10^{-2}$
Zinc	120,000	643,000	$1.5 \times 10^{-5}$	$4.0 \times 10^{-4}$	$7 \times 10^{-5}$	$2 \times 10^{-3}$
Total Hazard Index					$2 \times 10^{-2}$	$9 \times 10^{-1}$

**Notes:**

<sup>a</sup> Reference doses (RfDs) used to calculate hazard indices are shown in Table 2-4.

<sup>b</sup> Daily intake =  $\frac{(\text{Conc. soil mg/kg})(20 \text{ mg/visit})(160 \text{ visits/year})(10 \text{ years})(\text{Kg}/10^6 \text{ mg})}{(70 \text{ kg})(10 \text{ years})(365 \text{ days/year})}$  = (Conc. Soil mg/kg)( $1.25 \times 10^{-7}$  Kg soil/Kg body weight/day) under average exposure conditions (mg/kg/day)

Where Conc. Soil = Geometric mean

Daily intake under =  $\frac{(\text{Conc. Soil mg/kg})(100 \text{ mg/visit})(160 \text{ visit/year})(20 \text{ years})(\text{Kg}/10^6 \text{ mg})}{(70 \text{ kg})(20 \text{ years})(365 \text{ days/year})}$  = (Conc. Soil mg/kg)( $6.27 \times 10^{-7}$  Kg soil/Kg body weight/day) plausible maximum exposure conditions (mg/kg/day)

Where Conc. Soil = Maximum concentration

TABLE 2-18

DAILY INTAKE BY WORKERS VIA INGESTION OF GROUNDWATER AT THE SUMMIT NATIONAL SITE<sup>a</sup>  
SUMMIT NATIONAL FEASIBILITY STUDY

	Water Table				Intermediate Unit				Upper Sharon Aquifer <sup>b</sup>	
	Concentration (ug/l)		Average Intake	Plausible Maximum Intake	Concentration (ug/l)		Average Intake	Plausible Maximum Intake	Concentration (ug/l)	Average Intake (mg/kg/day)
	Geometric		(mg/kg/day)	(mg/kg/day)	Geometric		(mg/kg/day)	(mg/kg/day)		
	Mean	Maximum			Mean	Maximum				
Acetone	63	890,000	5.6x10 <sup>-4</sup>	8.0	91	1,300,000	8.2x10 <sup>-4</sup>	12	18	1.6x10 <sup>-4</sup>
Barium	100	320	9.0x10 <sup>-4</sup>	2.9x10 <sup>-3</sup>	136	2,230	1.2x10 <sup>-3</sup>	2.0x10 <sup>-2</sup>	12	1.1x10 <sup>-4</sup>
Bis(2-ethylhexyl) Phthalate	13	7,250	1.2x10 <sup>-4</sup>	6.5x10 <sup>-2</sup>	8	28	7.2x10 <sup>-5</sup>	2.6x10 <sup>-4</sup>	4	3.6x10 <sup>-5</sup>
Chromium	25	58	2.3x10 <sup>-4</sup>	5.2x10 <sup>-4</sup>	8.2	30	7.2x10 <sup>-5</sup>	2.7x10 <sup>-3</sup>	ND	ND
Cyanide	47	239	4.2x10 <sup>-3</sup>	2.2x10 <sup>-3</sup>	37	37	3.3x10 <sup>-4</sup>	3.3x10 <sup>-3</sup>	ND	ND
1,1-Dichloroethane	280	12,000	2.6x10 <sup>-4</sup>	1.1x10 <sup>-1</sup>	20	820	1.9x10 <sup>-4</sup>	7.3x10 <sup>-3</sup>	ND	ND
1,2-Dichloroethane	104	115,000	9.3x10 <sup>-4</sup>	1.0	140	5,800	1.3x10 <sup>-3</sup>	5.2x10 <sup>-2</sup>	ND	ND
1,1-Dichloroethene	35	2,600	3.2x10 <sup>-3</sup>	2.3x10 <sup>-2</sup>	ND	ND	ND	ND	ND	ND
t-1,2-Dichloroethene	121	4,600	1.1x10 <sup>-3</sup>	4.2x10 <sup>-2</sup>	ND	ND	ND	ND	ND	ND
Ethylbenzene	68	8,550	6.2x10 <sup>-2</sup>	7.8x10 <sup>-2</sup>	590	590	5.3x10 <sup>-3</sup>	5.3x10 <sup>-3</sup>	ND	ND
Phenol	2,400	7,000	2.2x10 <sup>-2</sup>	6.3x10 <sup>-2</sup>	490	910	4.5x10 <sup>-3</sup>	8.2x10 <sup>-3</sup>	6	5.4x10 <sup>-5</sup>
Toluene	25	20,000	2.3x10 <sup>-4</sup>	1.9x10 <sup>-1</sup>	39	3,200	3.5x10 <sup>-4</sup>	2.9x10 <sup>-2</sup>	ND	ND
Trichloroethene	900	27,000	8.1x10 <sup>-3</sup>	2.4x10 <sup>-1</sup>	55	55	4.9x10 <sup>-4</sup>	4.9x10 <sup>-4</sup>	ND	ND

## Notes:

ND Not detected

<sup>a</sup> Average daily intake =  $\frac{(\text{Conc. gw mg/l})(1 \text{ liter/day})(230 \text{ days})}{(70 \text{ kg})(365 \text{ days})}$  =  $(\text{Conc. gw mg/l})(9.0 \times 10^{-3} \text{ l/kg/day})$ ,  
where conc. gw equals the geometric mean concentration.  
Plausible maximum daily intake is calculated as above with Conc. gw equal to the maximum concentration.

<sup>b</sup> Based on samples from one well; therefore, no maximum is presented.

TABLE 2-19

CANCER RISKS TO WORKERS FROM INGESTION OF GROUNDWATER AT THE  
SUMMIT NATIONAL SITE<sup>a</sup>

	Water Table		Intermediate Unit		Upper Sharon Aquifer <sup>b</sup>
	Average	Plausible Max.	Average	Plausible Max.	
Bis (2-ethylhexyl) Phthalate	$1 \times 10^{-8}$	$1 \times 10^{-5}$	$7 \times 10^{-9}$	$5 \times 10^{-8}$	$4 \times 10^{-9}$
1,2-Dichloroethane	$1 \times 10^{-5}$	$3 \times 10^{-2}$	$2 \times 10^{-5}$	$1 \times 10^{-3}$	ND
1,1-Dichloroethene	$3 \times 10^{-5}$	$4 \times 10^{-3}$	ND	ND	ND
Trichloroethene	$1 \times 10^{-5}$	$8 \times 10^{-4}$	$8 \times 10^{-7}$	$2 \times 10^{-6}$	ND
Total Risk	$5 \times 10^{-5}$	$3 \times 10^{-2}$	$2 \times 10^{-5}$	$1 \times 10^{-3}$	$4 \times 10^{-9}$

**Notes:**

ND Not detected

<sup>a</sup> Daily intakes of chemicals in groundwater by workers are shown in Table 2-18. Cancer potency factors used to calculate cancer risks are shown in Table 2-4. For this analysis, the average daily dose received over the assumed exposure period was prorated over a 70-year lifetime, and the lifetime risk was calculated accordingly. This procedure is recommended in EPA's "Guidelines for Carcinogen Risk Assessment" (EPA 1986d).

<sup>b</sup> Risk based on samples from one well.

TABLE 2-20

NONCARCINOGENIC RISKS TO WORKERS FROM INGESTION OF GROUNDWATER AT THE  
SUMMIT NATIONAL SITE<sup>a</sup>

	Hazard Indices				
	Water Table		Intermediate Unit		Upper Sharon Aquifer <sup>b</sup>
	Average	Plausible Max.	Average	Plausible Max.	
Acetone	$6 \times 10^{-3}$	80	$8 \times 10^{-3}$	120	$2 \times 10^{-3}$
Barium	$2 \times 10^{-2}$	$6 \times 10^{-2}$	$2 \times 10^{-2}$	$4 \times 10^{-1}$	$2 \times 10^{-3}$
Bis (2-ethylhexyl) Phthalate	$6 \times 10^{-3}$	3	$4 \times 10^{-3}$	$1 \times 10^{-2}$	$2 \times 10^{-3}$
Chromium III	$2 \times 10^{-4}$	$5 \times 10^{-4}$	$7 \times 10^{-5}$	$3 \times 10^{-4}$	ND
Chromium VI	$5 \times 10^{-2}$	$1 \times 10^{-1}$	$3 \times 10^{-2}$	$6 \times 10^{-1}$	ND
Cyanide	$2 \times 10^{-2}$	$1 \times 10^{-1}$	$2 \times 10^{-2}$	$2 \times 10^{-2}$	ND
1,1-Dichloroethane	$2 \times 10^{-2}$	$9 \times 10^{-1}$	$2 \times 10^{-3}$	$6 \times 10^{-2}$	ND
1,1-Dichloroethene	$4 \times 10^{-1}$	3	ND	ND	ND
trans-1,2-Dichloroethene	$1 \times 10^{-3}$	4	ND	ND	ND
Ethyl benzene	$6 \times 10^{-1}$	$8 \times 10^{-1}$	$5 \times 10^{-2}$	$5 \times 10^{-2}$	ND
Phenol	$2 \times 10^{-1}$	$6 \times 10^{-1}$	$5 \times 10^{-2}$	$8 \times 10^{-2}$	$5 \times 10^{-4}$
Toluene	$8 \times 10^{-4}$	$6 \times 10^{-1}$	$1 \times 10^{-3}$	$1 \times 10^{-2}$	ND
Trichloroethene	1	33	$7 \times 10^{-2}$	$7 \times 10^{-2}$	ND
Total Hazard Index	1.5	126	$3 \times 10^{-1}$	121	$7 \times 10^{-3}$

Notes:

ND = Not detected

<sup>a</sup> Daily intakes of chemicals in groundwater by workers are shown in Table 2-18. Reference doses (RfDs) used to calculate hazard indices are shown in Table 2-4.<sup>b</sup> Risks based on samples from one well.



The potential excess lifetime cancer risks to workers from direct contact with onsite soil if the Summit National site is reused for light industrial work are shown in Table 2-16. The total excess cancer risks exceed  $10^{-6}$  for the plausible maximum, but not the average, exposure conditions evaluated. Under the plausible maximum exposure conditions, the potential excess cancer risks associated with exposure to PCBs, hexachlorobenzene, and PAHs are  $2 \times 10^{-4}$ ,  $2 \times 10^{-5}$ , and  $2 \times 10^{-6}$ , respectively. Excess cancer risks associated with the remaining potential carcinogens are  $4 \times 10^{-7}$  or lower. The estimated intakes by onsite workers of the indicator chemicals present in soil under both the average and plausible maximum cases are less than the available criteria for protection against noncarcinogenic effects of the carcinogenic and noncarcinogenic indicator chemicals considered. As shown in Table 2-17, the individual and total hazard indices for these chemicals are less than one. Thus, based on available data, it appears that noncarcinogenic health effects are not likely to result from exposure to the compounds shown in Table 2-17 for which critical toxicity values are available. It should, however, be noted that the total hazard index is close to one, primarily from potential exposure to antimony and cadmium. If other chemicals are present at the site which have similar end-points of toxicity (e.g., kidney effects for cadmium and heart and blood effects for antimony), but have not been specifically evaluated, exposure to chemicals at the site by direct contact with soils could also pose risks due to noncarcinogenic toxic effects. However, these risks are likely to be outweighed by the potential excess cancer risks.

The concentrations of indicator chemicals in each of the three water bearing units beneath the Summit National site are presented in Table 2-18 along with daily intakes by workers. The potential excess lifetime cancer risks to workers from ingestion of water from wells at the Summit National site are shown in Table 2-19. The total excess cancer risks associated with ingestion of groundwater from the water-table, or intermediate unit exceed  $10^{-6}$  under average and plausible maximum exposure conditions. The highest risks are associated with use of the water-table aquifer are due primarily to 1,1-dichloroethene, 1,2-dichloroethane, and trichloroethene. Risks associated with use of groundwater from the intermediate unit are somewhat lower and are due primarily

to 1,2-dichloroethane. The total excess cancer risk associated with ingestion of water from the Upper Sharon aquifer does not exceed  $10^{-6}$ .

Hazard indices for noncarcinogenic effects associated with the indicator chemicals present in groundwater beneath the Summit National site are shown in Table 2-20. The estimated intakes by onsite workers of acetone, bis(2-ethylhexyl)phthalate, 1,1-dichloroethene, trans-1,2-dichloroethene, and trichloroethene present in the water-table aquifer under plausible maximum exposure conditions each exceed the available criteria for protection against noncarcinogenic effects of these compounds. In addition, the total hazard index for exposure under average conditions to water from the water table aquifer exceeds one due primarily to the presence of trichloroethene. Not all chemicals present in the water-table aquifer exhibit the same end-points of toxicity. Consequently, if evaluated according to similar toxicity end-points, the total hazard indices for the average case in the water table aquifer may not exceed one. Conversely, consideration of other chemicals present at the site, but not specifically evaluated in this assessment, could potentially result in an even higher total hazard index. This type of analysis was not done because, although noncarcinogenic risks may be present, the potential carcinogenic risks associated with ingestion of groundwater appear to far outweigh the potential noncarcinogenic risks. The total hazard index for intake of chemicals present in the intermediate unit under plausible maximum, but not average, exposure conditions exceeds one, based primarily on exposure to acetone. It should be noted that hexavalent chromium is not expected to be the dominant species of this metal in groundwater. Accordingly, the potential noncarcinogenic health risks associated with exposure to chromium may actually be lower than estimated under the assumption that hexavalent chromium is the only species present. None of the indicator chemicals present in the Upper Sharon aquifer occur at concentrations that exceed available critical toxicity values. Thus, based on available data, it appears that noncarcinogenic health effects are not likely to result from exposure to chemicals present in the Upper Sharon aquifer for which critical toxicity values are available.

Under future conditions, workers at the Summit National site could potentially be exposed to chemical contaminants by both direct contact with soil and ingestion of groundwater. Consequently, both of these pathways would be expected to contribute to the potential health risks associated with exposure to these chemicals, and may be assumed to act additively.

The resulting total health risks would be dependent upon which water bearing zone or combination of zones groundwater was obtained from for ingestion. The total potential excess lifetime cancer risk to future workers at the site may range from  $2 \times 10^{-5}$  to  $2 \times 10^{-7}$  for the average exposure conditions. Under the plausible maximum exposure conditions the total potential excess lifetime cancer risks may range from  $3 \times 10^{-2}$  to  $2 \times 10^{-4}$ . For exposure to noncarcinogens, the total hazard index for indicator chemicals is less than one for exposure to soil and ingestion of water from the intermediate unit or Upper Sharon under average exposure conditions. Under all other conditions the total hazard index for exposure to indicator chemicals present in both soil and groundwater exceeds one.

Tables 2-21 through 2-25 present exposure estimates and risks to residents assuming the site is reused in the future for a residential dwelling. The potential excess lifetime cancer risks to residents from direct contact with onsite soil, if the Summit National Site is reused for residential dwellings, are shown in Table 2-21. The total excess risks exceed  $10^{-6}$  for both the plausible maximum and average exposure conditions evaluated. As with the onsite worker exposure, the greatest potential risks are associated with exposure to PCBs, PAHs and hexachlorobenzene. As shown in Table 2-22 under the average exposure conditions, non-carcinogenic health effects are not likely to result from exposure to the compounds evaluated for which critical toxicity values are available. However, under the plausible maximum exposure conditions, the estimated intake of antimony exceeds the available criteria for protection against non-carcinogenic effects. Consequently, the total hazard index for exposure under the plausible maximum exposure conditions exceeds one.

TABLE 2-21

EXPOSURE ESTIMATES AND CANCER RISKS FOR ONSITE RESIDENTS FROM DIRECT CONTACT WITH SOILS AT THE SUMMIT NATIONAL SITE<sup>a</sup>  
SUMMIT NATIONAL FEASIBILITY STUDY

Chemical	Concentration (ug/kg)		Daily Intake Prorated Over a 70-Year Lifetime <sup>b</sup> (mg/kg/day)		Cancer Risk	
	Geometric Mean	Maximum	Average	Plausible Maximum	Average	Plausible Maximum
Bis (2-ethylhexyl) Phthalate	10,000	700,000	$4.0 \times 10^{-6}$	$1.4 \times 10^{-3}$	$3 \times 10^{-9}$	$1 \times 10^{-6}$
1,2-Dichloroethane	1,300	23,000	$5.2 \times 10^{-7}$	$4.6 \times 10^{-4}$	$5 \times 10^{-8}$	$4 \times 10^{-6}$
Hexachlorobenzene	2,100	59,000	$8.5 \times 10^{-7}$	$1.2 \times 10^{-4}$	$1 \times 10^{-6}$	$2 \times 10^{-4}$
PCBs	4,600	590,000	$1.9 \times 10^{-7}$	$1.2 \times 10^{-3}$	$8 \times 10^{-6}$	$5 \times 10^{-3}$
PAHs	400	1,600	$1.6 \times 10^{-7}$	$3.2 \times 10^{-6}$	$2 \times 10^{-6}$	$4 \times 10^{-5}$
Trichloroethene	60	86,000	$2.4 \times 10^{-8}$	$1.7 \times 10^{-4}$	$3 \times 10^{-10}$	$2 \times 10^{-6}$
Total risk					$1 \times 10^{-5}$	$5 \times 10^{-3}$

<sup>a</sup>Cancer potency factors used to calculate cancer risks are shown in Table 2-4. For this analysis, the average daily dose received over the assumed exposure period was prorated over a 70-year lifetime, and the lifetime risk was calculated accordingly. This procedure is recommended in EPA's "Guidelines for Carcinogen Risk Assessment" (EPA 1986d).

<sup>b</sup>

Daily intake  
under average  
exposure con-  
ditions (mg/  
kg/day) =

$$= \frac{(\text{Conc. soil mg/kg})(0.92 \text{ mg/kg-visit})(160 \text{ visits/year})(70 \text{ years})(\text{kg}/10^6 \text{ mg})}{(70 \text{ years})(365 \text{ days/year})} = (\text{Conc. soil mg/kg})(4.03 \times 10^{-7} \text{ kg soil/kg body weight/day})$$

where: Conc. soil = geometric mean.

Daily intake  
under plausi-  
ble maximum  
exposure  
conditions  
(mg/kg/day) =

$$= \frac{(\text{Conc. soil mg/kg})(4.6 \text{ mg/kg-visit})(160 \text{ visits/year})(70 \text{ years})(\text{kg}/10^6 \text{ mg})}{(70 \text{ years})(365 \text{ days/year})} = (\text{Conc. soil mg/kg})(2.02 \times 10^{-6} \text{ kg soil/kg body weight/day})$$

where: Conc. soil = maximum concentration.

TABLE 2-22

EXPOSURE ESTIMATES AND NONCARCINOGENIC RISKS FOR ON-SITE RESIDENTS FROM DIRECT CONTACT WITH SOILS AT THE SUMMIT NATIONAL SITE<sup>a</sup>  
SUMMIT NATIONAL FEASIBILITY STUDY

Chemical	Concentration (ug/kg)		Chronic Daily Intake (CDI) <sup>b</sup> (mg/kg/day)		Hazard Index (CDI/RfD)	
	Geometric Mean	Maximum	Average	Plausible Maximum	Average	Plausible Maximum
Antimony	61,000	545,000	$2.5 \times 10^{-5}$	$1.1 \times 10^{-3}$	$6 \times 10^{-2}$	3
Bis (2-ethylhexyl) Phthalate	10,000	700,000	$4.0 \times 10^{-6}$	$1.4 \times 10^{-3}$	$2 \times 10^{-3}$	$7 \times 10^{-2}$
Cadmium	5,000	112,000	$2.0 \times 10^{-7}$	$2.3 \times 10^{-5}$	$3 \times 10^{-6}$	$4 \times 10^{-1}$
Phenol	2,100	44,000	$8.5 \times 10^{-8}$	$8.9 \times 10^{-4}$	$8 \times 10^{-6}$	$9 \times 10^{-4}$
Toluene	56	260,000	$2.3 \times 10^{-8}$	$5.2 \times 10^{-4}$	$8 \times 10^{-8}$	$2 \times 10^{-3}$
Trichloroethene	60	86,000	$2.4 \times 10^{-8}$	$1.7 \times 10^{-4}$	$3 \times 10^{-6}$	$2 \times 10^{-2}$
Total Xylenes	76	210,000	$3.1 \times 10^{-8}$	$4.2 \times 10^{-4}$	$3 \times 10^{-6}$	$4 \times 10^{-2}$
Zinc	120,000	643,000	$4.8 \times 10^{-5}$	$1.3 \times 10^{-3}$	$2 \times 10^{-4}$	$6 \times 10^{-3}$
Total Hazard Index					$6 \times 10^{-5}$	4

<sup>a</sup>Reference doses (RfDs) used to calculate hazard indices are shown in Table 2-4.

<sup>b</sup>

Daily intake  
under average  
exposure con-  
ditions (mg/  
kg/day)

$$= \frac{(\text{Conc. soil mg/kg})(0.92 \text{ mg/kg-visit})(160 \text{ visits/year})(70 \text{ years})(\text{kg}/10^6 \text{ mg})}{(70 \text{ years})(365 \text{ days/year})} = (\text{Conc. soil mg/kg})(4.03 \times 10^{-7} \text{ kg soil/kg body weight/day})$$

Daily intake  
under plausi-  
ble maximum  
exposure  
conditions  
(mg/kg/day)

$$= \frac{(\text{Conc. soil mg/kg})(4.6 \text{ mg/kg-visit})(160 \text{ visits/year})(70 \text{ years})(\text{kg}/10^6 \text{ mg})}{(70 \text{ years})(365 \text{ days/year})} = (\text{Conc. soil mg/kg})(2.02 \times 10^{-6} \text{ kg soil/kg body weight/day})$$

where: Conc. soil = maximum concentration.

TABLE 2-23

DAILY INTAKE BY RESIDENTS VIA INGESTION OF GROUNDWATER AT THE SUMMIT NATIONAL SITE<sup>a</sup>  
SUMMIT NATIONAL FEASIBILITY STUDY

	Water Table				Intermediate Unit				Upper Sharon Aquifer <sup>b</sup>	
	Concentration (ug/l)		Average Intake (mg/kg/day)	Plausible Maximum Intake (mg/kg/day)	Concentration (ug/l)		Average Intake (mg/kg/day)	Plausible Maximum Intake (mg/kg/day)	Concentration (ug/l)	Intake (mg/kg/day)
	Geometric Mean	Maximum			Geometric Mean	Maximum				
Acetone	63	890,000	$1.8 \times 10^{-3}$	$2.6 \times 10^{-1}$	91	1,300,000	$2.6 \times 10^{-3}$	$3.8 \times 10^{-1}$	18	$5.2 \times 10^{-4}$
Barium	100	320	$2.9 \times 10^{-3}$	$9.3 \times 10^{-3}$	136	2,230	$3.9 \times 10^{-3}$	$6.5 \times 10^{-2}$	12	$3.5 \times 10^{-4}$
Bis(2-ethylhexyl) Phthalate	13	7,250	$3.8 \times 10^{-4}$	$2.1 \times 10^{-1}$	8	28	$2.3 \times 10^{-4}$	$8.1 \times 10^{-4}$	4	$1.2 \times 10^{-4}$
Chromium	25	58	$7.3 \times 10^{-4}$	$1.7 \times 10^{-3}$	8.2	30	$2.4 \times 10^{-4}$	$8.7 \times 10^{-4}$	ND	ND
Cyanide	47	239	$1.4 \times 10^{-3}$	$6.9 \times 10^{-1}$	37	37	$1.1 \times 10^{-3}$	$1.1 \times 10^{-2}$	ND	ND
1,1-Dichloroethane	280	12,000	$8.1 \times 10^{-3}$	$3.5 \times 10^{-1}$	20	820	$5.8 \times 10^{-4}$	$2.4 \times 10^{-2}$	ND	ND
1,2-Dichloroethane	104	115,000	$3.0 \times 10^{-2}$	3.3	140	5,800	$4.1 \times 10^{-3}$	$1.7 \times 10^{-1}$	ND	ND
1,1-Dichloroethene	35	2,600	$1.0 \times 10^{-3}$	$7.5 \times 10^{-1}$	ND	ND	ND	ND	ND	ND
Trans-1,2-Dichloroethene	121	4,600	$3.5 \times 10^{-3}$	$1.3 \times 10^{-1}$	ND	ND	ND	ND	ND	ND
Ethylbenzene	68	8,550	$2.0 \times 10^{-3}$	$2.5 \times 10^{-1}$	590	590	$1.7 \times 10^{-2}$	$1.7 \times 10^{-2}$	ND	ND
Phenol	2,400	7,000	$7.0 \times 10^{-2}$	$2.0 \times 10^{-1}$	490	910	$1.4 \times 10^{-2}$	$2.6 \times 10^{-2}$	6	$1.7 \times 10^{-4}$
Toluene	25	20,000	$7.3 \times 10^{-4}$	$5.8 \times 10^{-1}$	39	3,200	$1.1 \times 10^{-3}$	$9.3 \times 10^{-3}$	ND	ND
Trichloroethene	900	27,000	$2.6 \times 10^{-2}$	$7.8 \times 10^{-1}$	55	55	$1.6 \times 10^{-3}$	$1.6 \times 10^{-3}$	ND	ND

ND Not detected

<sup>a</sup> Average daily intake =  $\frac{(\text{Conc. gw mg/l})(2 \text{ liter/day})(365 \text{ days})(70 \text{ years})}{(70 \text{ kg})(365 \text{ days})(70 \text{ years})} = (\text{Conc. gw mg/l})(2.9 \times 10^{-2} \text{ l/kg/day})$ ,

where conc. gw equals the geometric mean concentration

Plausible maximum daily intake is calculated as above with Conc. gw equal to the maximum concentration.

<sup>b</sup> Based on samples from one well; therefore, no maximum is presented.

TABLE 2-24

CANCER RISKS TO RESIDENTS FROM INGESTION OF GROUNDWATER AT THE SUMMIT NATIONAL SITE<sup>a</sup>  
SUMMIT NATIONAL FEASIBILITY STUDY

	Water Table		Intermediate Unit		Upper Sharon Aquifer <sup>b</sup>
	Average	Plausible Max.	Average	Plausible Max.	
Bis (2-ethylhexyl) Phthalate	$3 \times 10^{-7}$	$1 \times 10^{-4}$	$2 \times 10^{-7}$	$6 \times 10^{-7}$	$8 \times 10^{-8}$
1,2-Dichloroethane	$3 \times 10^{-4}$	$3 \times 10^{-1}$	$4 \times 10^{-4}$	$2 \times 10^{-2}$	ND
1,1-Dichloroethene	$6 \times 10^{-4}$	$4 \times 10^{-2}$	ND	ND	ND
Trichloroethene	$3 \times 10^{-4}$	$9 \times 10^{-3}$	$2 \times 10^{-5}$	$2 \times 10^{-5}$	ND
Total Risk	$1 \times 10^{-3}$	$3 \times 10^{-1}$	$4 \times 10^{-4}$	$2 \times 10^{-2}$	$8 \times 10^{-8}$

ND Not detected

<sup>a</sup> Daily intakes of chemicals in groundwater by residents are shown in Table 2-23. Cancer potency factors used to calculate cancer risks are shown in Table 2-4. For this analysis, the average daily dose received over the assumed exposure period was prorated over a 70-year lifetime, and the lifetime risk was calculated accordingly. This procedure is recommended in EPA's "Guidelines for Carcinogen Risk Assessment" (EPA 1986d).

<sup>b</sup> Risks based on samples from one well.

TABLE 2-25

NONCARCINOGENIC RISKS TO RESIDENTS FROM INGESTION OF GROUNDWATER AT THE SUMMIT NATIONAL SITE<sup>a</sup>  
SUMMIT NATIONAL FEASIBILITY STUDY

	Hazard Indices				
	Water Table		Intermediate Unit		Upper Sharon Aquifer <sup>b</sup>
	Average	Plausible Max.	Average	Plausible Max.	
Acetone	$2 \times 10^{-2}$	258	$3 \times 10^{-2}$	377	$5 \times 10^{-3}$
Barium	$6 \times 10^{-2}$	$2 \times 10^{-1}$	$8 \times 10^{-2}$	1	$7 \times 10^{-3}$
Bis (2-ethylhexyl) Phthalate	$2 \times 10^{-2}$	10	$1 \times 10^{-2}$	$4 \times 10^{-2}$	$6 \times 10^{-3}$
Chromium III	$7 \times 10^{-4}$	$2 \times 10^{-3}$	$2 \times 10^{-4}$	$9 \times 10^{-4}$	ND
Chromium VI	$1 \times 10^{-1}$	$3 \times 10^{-1}$	$5 \times 10^{-2}$	$2 \times 10^{-2}$	ND
Cyanide	$7 \times 10^{-2}$	$3 \times 10^{-1}$	$5 \times 10^{-2}$	$5 \times 10^{-2}$	ND
1,1-Dichloroethane	$7 \times 10^{-2}$	$4 \times 10^{-1}$	$5 \times 10^{-3}$	$2 \times 10^{-1}$	ND
1,1-Dichloroethene	$1 \times 10^{-1}$	8	ND	ND	ND
Trans-1,2-Dichloroethene	$4 \times 10^{-2}$	13	ND	ND	ND
Ethylbenzene	$2 \times 10^{-2}$	2.5	$2 \times 10^{-1}$	$2 \times 10^{-1}$	ND
Phenol	$7 \times 10^{-1}$	2	$1 \times 10^{-1}$	$3 \times 10^{-1}$	$2 \times 10^{-3}$
Toluene	$2 \times 10^{-3}$	2	$4 \times 10^{-3}$	$3 \times 10^{-1}$	ND
Trichloroethene	3	100	$2 \times 10^{-1}$	$2 \times 10^{-1}$	ND
Total Hazard Index	4.6	400	$7 \times 10^{-1}$	380	$2 \times 10^{-2}$

Notes:

ND = Not detected

<sup>a</sup> Daily intakes of chemicals in groundwater by residents are shown in Table 2-23. Reference doses (RfDs) used to calculate hazard indices are shown in Table 2-4.

<sup>b</sup> Risks based on samples from one well.



As indicated in Table 2-23, exposure from ingestion of groundwater is determined assuming residents drink approximately two liters of groundwater per day over a lifetime. The potential excess lifetime cancer risks to residents from ingestion of groundwater from the water-table and intermediate unit beneath the site exceed  $10^{-6}$  under average and plausible maximum exposure conditions (Table 2-24). The potential excess lifetime cancer risks to residents ingesting groundwater from the Upper Sharon aquifer is less than  $10^{-6}$ .

Hazard indices for non-carcinogenic effects to residents associated with the ingestion of indicator chemicals present in groundwater beneath the Summit National site are presented in Table 2-25. Using the maximum concentrations, the hazard indices from both the water table and intermediate unit exceed one; using average concentrations only the hazard index in the water table exceeds one. Under these conditions, non-carcinogenic health effects may result from ingestion of groundwater beneath the site for a lifetime. In order to evaluate the potential significance of hazard indices that exceed one, it is necessary to determine whether the chemicals have similar end-points of toxicity. However, an evaluation of the end-points of toxicity was not done because the potential excess carcinogenic risks associated with ingestion of groundwater are significant and appear to far outweigh the potential non-carcinogenic risks.

Under future residential use of the Summit National site, residents could potentially be exposed to chemical contaminants by both direct contact with soil and ingestion of groundwater. Consequently, both these pathways would be expected to contribute to the overall potential health risks associated with exposure to these chemicals, and may be assumed to act additively.

The resulting total health risk would be dependent upon the specific water bearing zone or combination of zones groundwater was obtained from for ingestion. The total potential excess lifetime cancer risks to future site residents may range from  $1 \times 10^{-3}$  to  $1 \times 10^{-5}$  for the average exposure conditions and under the plausible maximum exposure conditions the total potential excess lifetime cancer risks may range from  $3 \times 10^{-1}$  to  $5 \times 10^{-3}$ . For exposure to noncarcinogens, the total hazard index for indicator chemicals is less than one for exposure to soil and ingestion of water from the intermediate unit or Upper Sharon under average exposure conditions. Under all other conditions, the total hazard index for exposure indicator chemicals in these two media exceeds one.

## 2.6 CONCLUSIONS

Based on the results of this public health evaluation, risks to human health may exist at the Summit National site under a number of exposure scenarios. A summary table showing potential risks associated with the site is presented in Table 2-26.

TABLE 2-26

## SUMMARY OF POTENTIAL RISKS ASSOCIATED WITH THE SUMMIT NATIONAL SITE

Exposure Scenario	Total Cancer Risks		Noncarcinogenic Hazard Index	
	Average	Plausible Maximum	Average	Plausible Maximum
<u>Current Conditions - Soil</u>				
On-site trespassers	$1 \times 10^{-8}$	$3 \times 10^{-5}$	<1	<1
Off-site workers (southern perimeter)	$6 \times 10^{-7}$	$4 \times 10^{-5}$	<1	<1
Off-site residents (eastern perimeter)	$3 \times 10^{-6}$	$2 \times 10^{-4}$	<1	<1
<u>Current Conditions - Sediment</u>				
Children in ditches	$2 \times 10^{-7}$	$6 \times 10^{-6}$	<1	>1
Teenagers in second impoundment	$6 \times 10^{-12}$	$1 \times 10^{-7}$	<1	<1
<u>Future Conditions</u>				
On-site workers				
Soil	$2 \times 10^{-7}$	$2 \times 10^{-4}$	<1	<1
Groundwater				
Water Table	$5 \times 10^{-5}$	$3 \times 10^{-2}$	>1	>1
Intermediate Unit	$2 \times 10^{-5}$	$1 \times 10^{-3}$	<1	>1
Upper Sharon Aquifer	$4 \times 10^{-9}$	NA	<1	NA
On-site residents				
Soil	$1 \times 10^{-5}$	$5 \times 10^{-3}$	<1	>1
Groundwater				
Water Table	$1 \times 10^{-3}$	$3 \times 10^{-1}$	>1	>1
Intermediate Unit	$4 \times 10^{-4}$	$2 \times 10^{-2}$	<1	>1
Upper Sharon Aquifer	$8 \times 10^{-8}$	NA	<1	NA

NA = not applicable, only one representative sample.

## CHAPTER 3

### REMEDIAL TECHNOLOGY DEVELOPMENT

In this chapter, remedial technologies are identified in terms of general response actions that address the site problems as defined by the remedial goals. These remedial technologies are then screened to eliminate those technologies that are infeasible. The specific methodology includes identifying:

- Remedial action goals based on site contaminated media and the results of the public health evaluation for existing conditions.
- General response actions that meet the remedial goals.
- Possible technologies for each general response action, followed by the screening of these technologies to eliminate inapplicable technologies.

#### 3.1 REMEDIAL RESPONSE ACTION GOALS

The NCP states, "The appropriate extent of remedy shall be determined by the lead agency's selection of a cost-effective remedial alternative that effectively mitigates and minimizes threats to and provides adequate protection of public health and welfare and the environment" (40 CFR 300.68(i)). This is the general goal of all CERCLA feasibility studies.

The nature and extent of site hazards summarized in the Summit RI form the basis for identifying specific objectives for remediating contaminated soil and subsurface wastes (buried drums and tanks), sediment, surface water, and groundwater and associated free product. The risks that were identified at the site in the public health risk assessment (summarized in Chapter 2) establish the basis for identifying site-specific goals of remedial measures. The public health risk assessment identified either existing or potential future public health or environmental risks in the following media: soil, sediment, and groundwater. The following goals for the Summit National Site identify the receptors to be protected, the exposure route, the area of existing or potential hazards, and the contaminants of concern. These goals will comply with CERCLA Section 121 and reflect the NCP objective to "mitigate and minimize threats" and "provide adequate protection" (40 CFR 300.68(i)), to the maximum extent practicable.

Table 3-1 shows standards and criteria for water and Tables 3-2 and 3-3 show concentrations of indicator chemicals in soils and sediment, respectively, at which certain standards, criteria, and risks will not be exceeded. The cleanup levels in soil are developed using the residential future use scenario and are based on lifetime exposure through direct contact and incidental ingestion of surface soil. These cleanup levels are derived using the same methodology that was used to estimate risk in the public health evaluation (PHE). For carcinogens, upperbound lifetime excess cancer target risk levels of  $10^{-4}$ ,  $10^{-6}$ , and  $10^{-7}$  are evaluated. This carcinogenic risk range was selected for evaluation based on Section 9.2 of the Superfund Public Health Evaluation manual (USEPA, October, 1986). For noncarcinogens, the exposure equivalent to a chronic daily intake/risk reference dose ratio of one is evaluated. The chronic daily intakes associated with these target risk levels are used to derive the cleanup concentrations in soil by back calculation from the health effects criteria presented in Table 6-7 of the Summit National RI.

The assumptions used in evaluating target cleanup levels for soil at the site under this hypothetical future residential use scenario are presented in Table 6-16 of the RI. It is assumed that an individual could be exposed for 160 days/year throughout an entire lifetime (i.e. 70 years). Average lifetime soil ingestion rates were estimated based on the age-specific soil ingestion rates presented in Appendix H of the RI as 0.92 mg/kg-visit and 4.6 mg/kg-visit for the average and plausible maximum exposure case, respectively. It is assumed that the primary route of exposure is by incidental ingestion of contaminated soil and that exposure through dermal absorption would not increase the total intake of contaminants in soil by more than a factor of 2. A conservative oral absorption factor of 1 is used for all of the indicator chemicals considered.

For evaluating target cleanup levels for sediment, the same methodology was used as for soils with the following exceptions. It was assumed that children, aged 4 to 6 play in the lower east, east, and south ditches and first impoundment 32 and 64 times per year for the average and plausible maximum scenarios, respectively. Exposure occurs through incidental ingestion of sediment, and it is assumed that 100 mg are ingested per visit under average conditions and 500 mg per visit are ingested under plausible maximum exposure conditions. These assumptions are presented in Table 6-19 of the RI.

TABLE 3-1  
Water Contaminant Criteria Standards for Indicator Chemicals  
Summit National Site Feasibility Study

Indicator Chemical	Safe Drinking Water Act			Ambient Water Quality Criteria				State of Ohio Requirements	
	Maximum Contaminant Level(ug/l)(1)	Proposed Maximum Contaminant Level(ug/l)(2)	Recommended Maximum Contaminant Level MCLG(ug/l)(3)	Protection of Freshwater Aquatic Life(ug/l)(4)	Protection of Human Health (ug/l)(5)	EPA Health Advisories (ug/l)(6)	Acceptable Daily Intake (mg/kg-Day)(7)	Ohio Water Quality Standards (ug/l)(8)	
Antimony	NR	NR	NR	9,000 A 1,600 A	146	NR	4.0E-4	NR	
Acetone	NR	NR	NR	NR	NR	NR	0.1	78,000	
Barium	1,000	NR	1,500	NR	NR	1,800 LT	0.051	NR	
Bis(2-ethylhexyl)phthalate	NR	NR	NR	940 A 3 C	1,000	NR	2.0E-2	0.18	
Chlorobenzene	NR	NR	60	250 A 50 C	488	1,800 - 1 Day 1,800 - 10 Day 3,150 - LT	2.7E-2	26	
Chromium(VI)*	50	NR	120	16 A 11 C	90	1,400 - 1 Day 1,400 - 10 Day 170 - LT	5.0E-3	10	
Cyanides	NR	NR	NR	22 A 5.2 C	200	220 - 1 Day 220 - 10 Day 750 - LT	2.0E-2	8.1	
1,1-dichloroethane	NR	NR	NR	NR	NR	NR	0.12	NR	
1,2-dichloroethane	NR	5	NR	118,000 A 20,000 C	(0.94)	740 - 1 Day 740 - 10 Day 2,600 - LT	NR	3,500	
1,1-dichloroethene	NR	7	NR	11,600 A	(0.033)	1,000 - 1 Day 1,000 - 10 Day 3,500 - LT	9.00E-3	NR	
Trans 1,2-dichloroethene	NR	NR	70	11,600 A	(0.033)	2,720 - 1 Day 1,000 - 10 Day 350 - LT	NR	310	
Ethylbenzene	NR	NR	680	32,000 A	1,400	2,100 - 1 Day 2,100 - 10 Day 3,400 - LT	0.1	62	
Hexachloroethane	NR	NR	NR	980 A 540 C	1.9	NR	NR	NR	
Nickel*	NR	NR	NR	133 A 8 C	13.4	NR - 1 Day 1,000 - 10 Day 350 - LT	1.0E-2	506	
Phenol	NR	NR	NR	10,200 A 2,560 C	3,500	NR	NR	370	

TABLE 3-1 (Continued)

Water Contaminant Criteria Standards for Indicator Chemicals  
Summit National Site Feasibility Study

Indicator Chemical	Safe Drinking Water Act				Ambient Water Quality Criteria			State of Ohio Requirements
	Maximum Contaminant Level (ug/l)(1)	Proposed Maximum Contaminant Level (ug/l)(2)	Recommended Maximum Contaminant Level MCLG (ug/l)(3)	Protection of Freshwater Aquatic Life (ug/l)(4)	Protection of Human Health (ug/l)(5)	EPA Health Advisories (ug/l)(6)	Acceptable Daily Intake (mg/kg-Day)(7)	Ohio Water Quality Standards (ug/l)(8)
Polynuclear aromatic hydrocarbons (PAH)	NR	NR	NR	NR	2.8E-3	NR	NR	NR
Tetrachlorethene	NR	NR	0	5,280 A 840 C	(0.8)	NR - 1 Day 34,000 - 10 Day 6,800 - LT	2.0E-2	73
Toluene	NR	NR	2,000	17,500 A	14,300	18,000 - 1 Day 6,000 - 10 Day 10,800 - LT	0.3	1,700
Trichloroethene	NR	5	NR	45,000 A 21,900 C	(2.7)	NR	NR	75
Vinyl Chloride	NR	1	NR	NR	(2)	2,600 - 1 Day 2,600 - 10 Day 46 - LT	NR	NR
Zinc*	(5000)	NR	NR	462 A 47 C	NR	NR	0.21	270

NOTES: NR - Not Reported  
(Secondary Standard)

\* Water quality standards for Chromium, Nickel, and Zinc are dependent on water hardness and are therefore variable.

1. USEPA, 1986. Superfund Public Health Evaluation Manual. Office of Emergency and Remedial Response. Exhibit 4-5
2. IBID, Exhibit 4-7
3. IBID, Exhibit 4-6

Criteria presented are for the ingestion of aquatic organisms and drinking water. Concentrations given in parenthesis(), are for potential carcinogens corresponding to a risk of  $10^{-6}$  which is the midpoint of the range  $10^{-5}$  to  $10^{-7}$  given in the water quality criteria documents.

4. USEPA, February 1984, Water Quality Criteria Documents; Availability, Federal Register, Vol. 49, No. 26.  
USEPA, November, 1980, Water Quality Criteria Documents; Availability. Federal Register, Vol. 45, No. 231.  
Criteria presented for the protection of freshwater aquatic life.

A = Acute toxicity concentration value.

C = Chronic toxicity concentration value.

5. USEPA, 1986. Superfund Public Health Evaluation Manual. Office of Emergency and Remedial Response. Exhibit 4-8.  
One-day and 10-day values given for a 10 kg child consuming one liter of water per day. LT = Long Term Value for 70 kg adult consuming 2 liters of water per day.
6. IBID, Exhibit C-6
7. IBID, Exhibit C-4
8. Ohio EPA, April 1987, Ohio Water Quality Standards. Chapter 3745-1 of the Ohio Administrative Code

TABLE 3-2

CLEANUP LEVELS BASED ON  
LIFETIME RESIDENTIAL EXPOSURE TO INDICATOR CHEMICALS IN SOILS  
SUMMIT NATIONAL FEASIBILITY STUDY

Chemical	Soil Concentrations in mg/kg Based on a Chronic Intake/Risk Reference Dose Ratio of 1.0		Soil Concentrations in mg/kg Based on Upperbound Lifetime Cancer Risks* of:			
	Average Exposure	Maximum Exposure	$10^{-4}$	$10^{-5}$	$10^{-6}$	$10^{-7}$
Antimony	$9.9 \times 10^2$	$2.0 \times 10^2$	NA	NA	NA	NA
Bis(2-ethylhexyl)Phthalate	$5.0 \times 10^4$	$9.9 \times 10^3$	$7.2 \times 10^4$	$7.2 \times 10^3$	$7.2 \times 10^2$	$7.2 \times 10$
Cadmium	$1.5 \times 10^3$	$2.9 \times 10^2$	NA	NA	NA	NA
1,2-Dichloroethane	NA	NA	$5.4 \times 10^2$	$5.4 \times 10$	5.4	$5.4 \times 10^{-1}$
Hexachlorobenzene	NA	NA	$2.9 \times 10$	2.9	$2.9 \times 10^{-1}$	$2.9 \times 10^{-2}$
PCBs	NA	NA	$1.1 \times 10$	1.1	$1.1 \times 10^{-1}$	$1.1 \times 10^{-2}$
PAHs	NA	NA	4.3	$4.3 \times 10^{-1}$	$4.3 \times 10^{-2}$	$4.3 \times 10^{-3}$
Phenol	$2.5 \times 10^5$	$5.0 \times 10^4$	NA	NA	NA	NA
Toluene	$7.4 \times 10^5$	$1.5 \times 10^5$	NA	NA	NA	NA
Trichloroethene	$1.8 \times 10^4$	$3.6 \times 10^3$	$4.5 \times 10^3$	$4.5 \times 10^2$	$4.5 \times 10$	4.5
Total Xylenes	$2.5 \times 10^4$	$5.0 \times 10^3$	NA	NA	NA	NA
Zinc	$5.2 \times 10^5$	$1.0 \times 10^5$	NA	NA	NA	NA

\* Cleanup levels presented for carcinogenic indicator chemicals are based on plausible maximum exposure.



TABLE 3-3

CLEANUP LEVELS BASED ON  
LIFETIME RESIDENTIAL EXPOSURE TO INDICATOR CHEMICALS IN SEDIMENTS  
SUMMIT NATIONAL FEASIBILITY STUDY

Chemical	Sediment Concentrations in mg/kg Based on a Chronic Intake/Risk Reference Dose Ratio of 1.0		Sediment Concentrations in mg/kg Based on Upperbound Lifetime Cancer Risks* of:			
	Average Exposure	Maximum Exposure	$10^{-4}$	$10^{-5}$	$10^{-6}$	$10^{-7}$
Antimony	$8.7 \times 10^2$	$8.7 \times 10$	NA	NA	NA	NA
Bis(2-ethylhexyl)Phthalate	$4.3 \times 10^4$	$4.3 \times 10^3$	$7.4 \times 10^5$	$7.4 \times 10^4$	$7.4 \times 10^3$	$7.4 \times 10^2$
1,2-Dichloroethane	NA	NA	$5.6 \times 10^3$	$5.6 \times 10^2$	$5.6 \times 10$	5.6
PCBs	NA	NA	$1.2 \times 10^2$	$1.2 \times 10$	1.2	$1.2 \times 10^{-1}$
PAHs	NA	NA	$4.4 \times 10$	4.4	$4.4 \times 10^{-1}$	$4.4 \times 10^{-2}$
Di-n-Butylphthalate	$2.2 \times 10^5$	$2.2 \times 10^4$	NA	NA	NA	NA
Zinc	$4.6 \times 10^5$	$4.6 \times 10^4$	NA	NA	NA	NA

\* Cleanup levels for carcinogenic indicator chemicals are based on plausible maximum exposure presented.

### 3.1.1 Soil and Subsurface Wastes

The remedial action goal for soil and subsurface wastes is the adequate protection of the environment and public health from dermal absorption or incidental ingestion of containerized materials or vadose soil contaminated with metals, PAH's, PCB's, or other potentially hazardous substances.

### 3.1.2 Sediment

The remedial action goal for sediment is the adequate protection of the environment and public health from dermal absorption, or incidental ingestion of sediment in the areas of the southern boundary and east drainage ditches, onsite ponds and the first impoundment, contaminated with PCB's and other potentially hazardous substances. The PHE indicated no site related risks are associated with the second impoundment sediments.

### 3.1.3 Surface Water

The remedial action goal for surface water is the adequate protection of the environment and public health from dermal absorption or incidental ingestion of contaminants in water from onsite ponds and their offsite discharge to local surface waters. This includes prevention of any future release of hazardous substances to the surface water from landfill leachate, groundwater discharge, or soil erosion. Surface water is contaminated with metals, PAH's, and other potentially hazardous substances.

### 3.1.4 Groundwater and Associated Free Product

The remedial action goal for groundwater and any associated free product is the adequate protection of the environment and of public health from dermal absorption, inhalation, or ingestion of contaminated groundwater extracted from the water table aquifer or the Upper Intermediate Unit beneath or near the site and the prevention of contaminant migration to deeper aquifers. The water table aquifer and Upper Intermediate Unit are contaminated with 2-butanone, phenol, toluene, bis (2-ethylhexyl) phthalate, and other potentially hazardous substances.

## 3.2 GENERAL RESPONSE ACTIONS

General response actions are broad classes of responses or remedies intended to meet the remedial action goals at the site. Several response actions have been identified for each of the following operable units: soil and subsurface

wastes (buried drums and tanks), sediment, surface water, and groundwater and associated free product. Each operable unit is a contaminated medium or group of media which can be addressed independently of other media. Although some response actions may be capable of meeting the remedial objectives alone, combinations of response actions may later prove to be more effective in meeting the remedial goals and objectives. Combinations of response actions are considered further in Chapter 4.

Within each general response action, specific technologies are identified to achieve the response. For instance, capping and vertical barriers are two technologies for the containment response action. For each technology, there are one or more process options which refer to the material, equipment, or methodology used to implement the technology. For instance, slurry walls, grout curtains, and sheet pilings are different process options for the vertical barrier technology. Table 3-4 presents the general response actions for each of the operable units.

TABLE 3-4  
SUMMIT NATIONAL SITE FEASIBILITY STUDY

GENERAL RESPONSE ACTIONS

<u>Operable Unit</u>	<u>General Response Actions</u>
Soil and Subsurface Waste	No Action Access Restrictions Containment Removal Treatment Disposal Other Management Options
Sediment	No Action Access Restrictions Containment Removal Treatment Disposal Other Management Options
Surface Water	No Action Access Restrictions Containment Collection Treatment Disposal Other Management Options
Groundwater/Free Product	No Action Access Restrictions Containment Collection Treatment Disposal Other Management Options

### 3.3 APPLICABLE REMEDIAL TECHNOLOGIES

Remedial technologies and corresponding process options were screened to identify applicable technologies to be further evaluated, screened, and assembled into alternatives in the following chapter. The screening includes consideration of five criteria:

- Site conditions
- Waste characteristics
- Ability to meet objectives of NCP
- Implementability of technology
- Demonstrated performance of technology

The site conditions and waste characteristics that influence selection of remedial technologies are presented in Table 3-5.

Figures 3-1, 3-2 and 3-3 present the technologies and process options screened and those remaining after screening for the general response actions within each operable unit. The sediment operable unit has been combined with the soil and subsurface wastes operable unit in Figure 3-1 because of similar remedial technologies and similar remedial goals. Options that have been shaded on the figures are not considered applicable to the operable unit. A brief discussion of process options and screening results is included in Tables 3-6, 3-7 and 3-8. Those process options and technologies that are screened out at this stage are not carried forward for detailed analysis in the following chapter.

TABLE 3-5  
SUMMIT NATIONAL SITE FEASIBILITY STUDY

SITE AND WASTE CHARACTERISTICS

WASTE CHARACTERISTICS

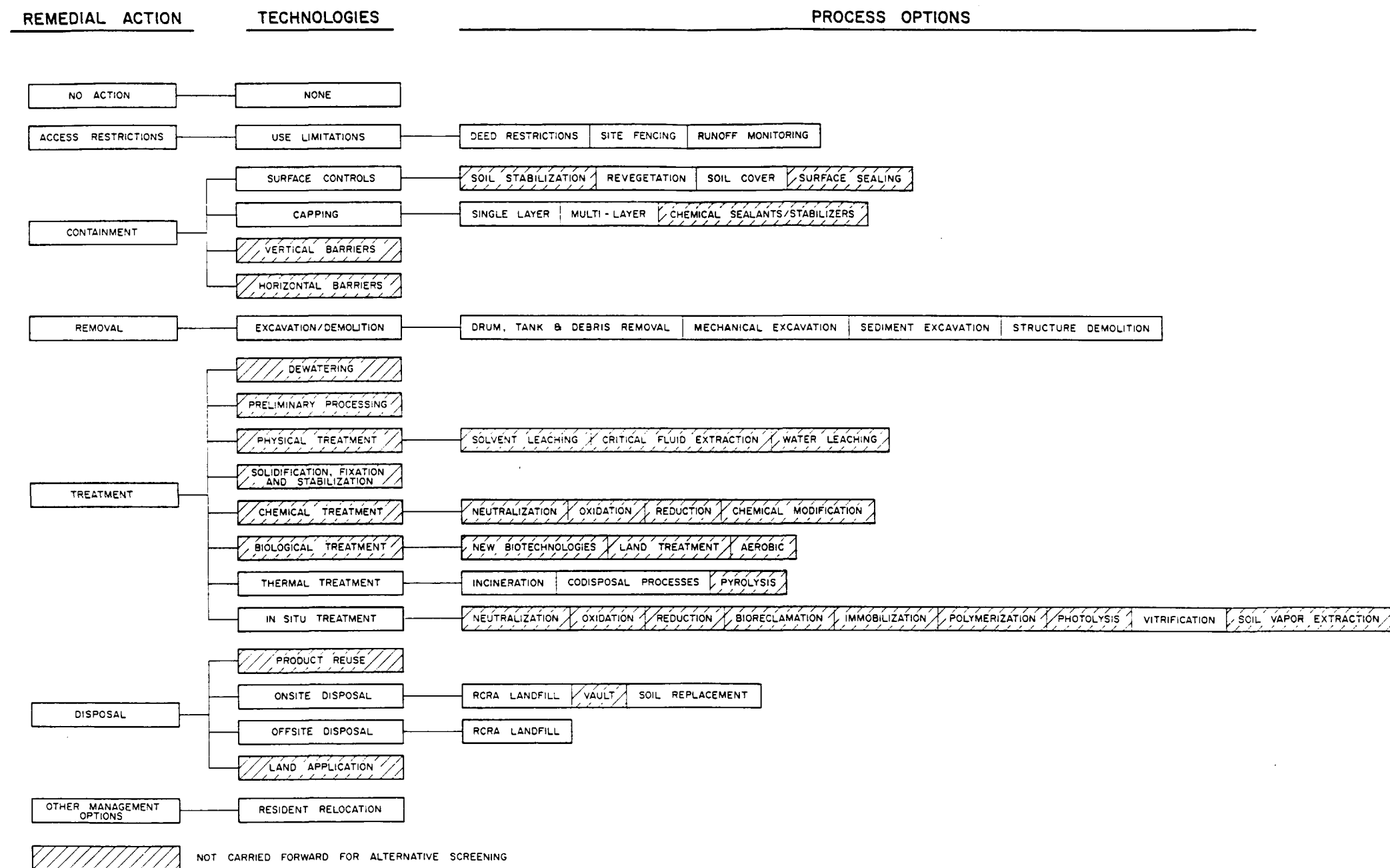
Unknown Quantity of Hazardous Substances  
Chemical Composition  
Concentrations of Contaminants  
Toxicity and Carcinogenicity of Contaminants  
Persistence  
Biodegradability  
Ease of Transport  
Solubility  
Volatility  
Ignitability  
Density  
Partition Coefficient  
Compatability with Other Chemicals  
Treatability  
Physical State

SITE PHYSICAL CHARACTERISTICS

Site Area of 12 Acres  
Climate  
Soil/Mine Spoil Characteristics  
Drainage Patterns  
Slope  
Vegetation  
Depth to Water Table of 5 to 12 ft.  
Direction and Quantity of Groundwater Flow  
Degree of Hydraulic Connection Between Water Table and Deeper Aquifers  
Groundwater Surface Discharges  
Receptors  
Offsite Residential Wells and Location  
Surface Waters  
Past Remedial Activities

TABLE 3-6  
IDENTIFICATION OF APPLICABLE SOIL/SEDIMENT/SUBSURFACE WASTE  
TECHNOLOGIES AND PROCESS OPTIONS  
SUMMIT NATIONAL FEASIBILITY STUDY

General Response Action	Remedial Technology and Process Option	Retained for Further Analysis	Screening Comments
NO ACTION	NONE Leave site as is.	Yes	The NCP requires No Action to be carried through to detailed analysis of alternatives. Health and environmental hazards make this a non-viable option.
ACCESS RESTRICTIONS	USE LIMITATIONS <u>Deed Restrictions</u> : All deeds for property within potentially contaminated areas would include restrictions on use of property.  <u>Site Fencing</u> : Fencing around the site and drainage ditches would be completed. All fencing would be maintained as necessary.  <u>Runoff Monitoring</u> : Collect and analyze storm water and transported soil/sediment runoff to detect changes in runoff quality.	Yes  Yes  Yes	Viable alternative for reducing exposure to contaminated soil.  Viable alternative for reducing human and animal exposure to onsite contaminants.  Contaminated surface water and sediment are transported off site. Monitoring stations should be located outside the existing site boundaries.
CONTAINMENT	SURFACE CONTROLS <u>Soil Stabilization</u> . Chemical binders and tacks are sprayed on bare soils or mulches to coat, penetrate and bind together the particles, thus reducing erosion and soil water loss and enhancing plant growth.  <u>Revegetation</u> . Establish vegetative cover which will reduce erosion and contribute to the development of a naturally fertile and stable surface environment. Vegetation may be grasses, shrubs, legumes, or trees.  <u>Soil Cover</u> . Cover site with soil and establish vegetative cover to reduce potential for direct contact, erosion, volatilization or dust generation.  <u>Surface Sealing</u> . Application of water, emulsions or resins to form erosion resistant surface.	No  Yes  Yes  No	Short term solution only; does not meet goals of NCP. Prevents erosion, but does not reduce leaching of soil contaminants to saturated zone.  Viable alternative, particularly following the implementation of other remedial technologies such as capping or grading.  Viable alternative, but following implementation of other remedial technologies.  This is only a temporary solution. May be applicable during construction phase of other technologies, but as a long-term remedy this technology does not meet NCP goals.



REFER TO TABLE 3-6 FOR SCREENING DISCUSSIONS

FIGURE 3-1  
SOIL/SEDIMENT/  
SUBSURFACE WASTE TECHNOLOGIES  
SUMMIT NATIONAL FS



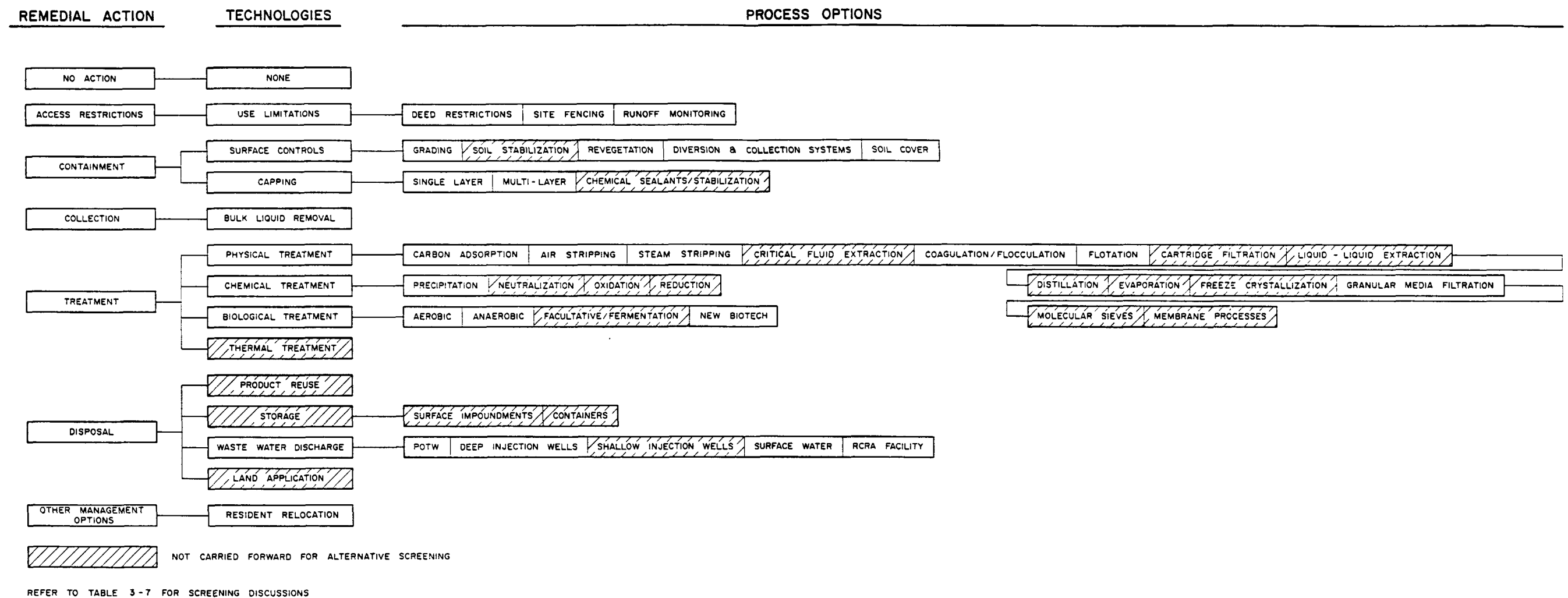
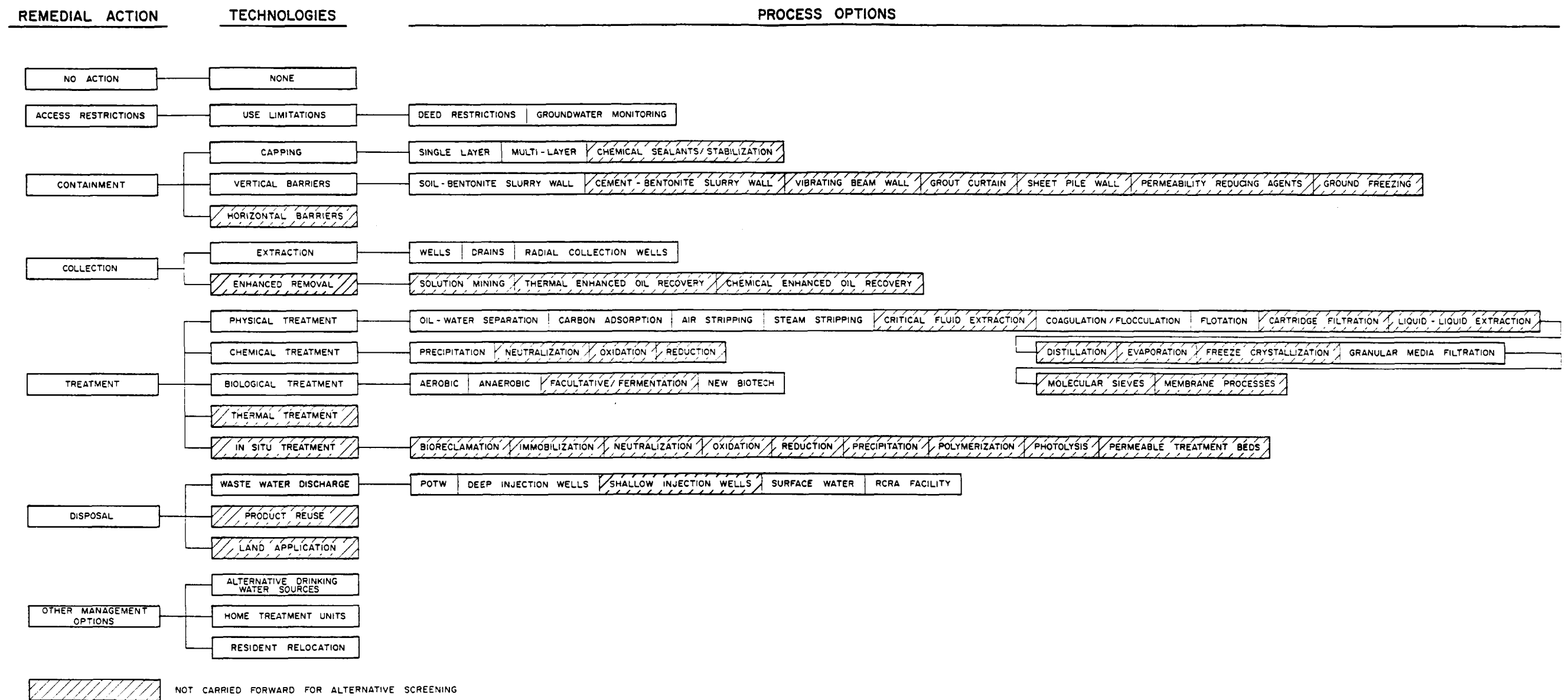


FIGURE 3-2  
 SURFACE WATER TECHNOLOGIES  
 SUMMIT NATIONAL FS



REFER TO TABLE 3-8 FOR SCREENING DISCUSSIONS

FIGURE 3-3  
GROUNDWATER TECHNOLOGIES  
SUMMIT NATIONAL FS

TABLE 3-6 (Page 2 of 7)

General Response Action	Remedial Technology and Process Option	Retained for Further Analysis	Screening Comments
CONTAINMENT (cont'd)	CAPPING		
	<u>Single Layer Cap.</u> Cover contaminated solids with a single layer of low permeability material such as clay, asphalt, or concrete to contain contaminated solids.	Yes	Viable alternative
	<u>Multi-layered Cap.</u> Combine several layers of cover materials such as soil, synthetic membrane, and clay to provide erosion and moisture control in addition to containing the soil or sediment.	Yes	Viable alternative. Will significantly reduce volume of contaminants leaching to groundwater or eroding to surface water.
	<u>Chemical Sealants/Stabilizers.</u> Application of water dispersible emulsions or resins which form a protective crust over soil.	No	Temporary solution. Does not meet long-term goals of MCP.
	VERTICAL BARRIERS		
	Use of slurry walls, grout curtains, sheet piles or vibrating beam methods to reduce horizontal contaminant migration.	No	Horizontal migration of soil, sediment, or subsurface waste contaminants in unsaturated zone is not likely. Migration of contaminants below water table is addressed in the groundwater operable unit.
REMOVAL	HORIZONTAL BARRIERS		
	Use of block displacement or injection grouting to reduce downward migration of contaminants into saturated zone.	No	Use of block displacement and injection grouting is experimental and unproven for producing horizontal barriers.
	EXCAVATION/DEMOLITION		
	<u>Drum, Tank and Debris Removal.</u> Remove buried drums, tanks, and debris using conventional construction equipment with drum grapple attachments or other applicable equipment. The drum and tank removal process includes staging, opening, transport and monitoring.	Yes	Viable alternative as buried drums and tanks are located on site.
	<u>Mechanical Excavation.</u> Excavate contaminated soil by means of conventional construction equipment such as backhoes, hydraulic excavators, front-end loaders, bulldozers, or hand tools. Larger equipment such as dragline or clamshell excavators may be utilized for deep excavation.	Yes	Viable alternative for removal of contaminated solids.

TABLE 3-6 (Page 3 of 7)

General Response Action	Remedial Technology and Process Option	Retained for Further Analysis	Screening Comments
REMOVAL (cont'd)	<u>Sediment Excavation.</u> Removal of sediments by various methods, such as conventional excavating equipment, or hydraulic or pneumatic dredging equipment.	Yes	Viable alternative for removal of contaminated sediments.
	<u>Structure Demolition.</u> Demolish onsite structures using conventional construction equipment.	Yes	Elimination of existing onsite structures is necessary to facilitate any remedial actions.
TREATMENT	DEWATERING Decrease in water content of solid or semi-solid waste by use of various physical processes, such as gravity thickening, centrifuges, belt filter presses, etc., or the use of drying beds to remove excess water.	No	Considered to be a pretreatment step that would be analyzed in conjunction with other technologies.
	PRELIMINARY PROCESSING Pretreatment of solid wastes by various methods, such as crushing and grinding, separation of metal by magnetic processes, separation by screening, etc.	No	Considered as a pretreatment alternative, does not remediate solids contamination. Likely to be a necessary step in various other treatment processes.
	PHYSICAL TREATMENT <u>Solvent Leaching.</u> Removal of contaminants soluble in the leaching solvent by flushing with the solvent. The solvent must be treated or disposed.	No	Process would generate large volume of contaminated solvent to be treated.
	<u>Critical Fluid Extraction.</u> Extraction of organics from solid wastes by forcing a solvent (generally CO <sub>2</sub> ) at its critical point through the waste. Organic components are transferred to the solvent. Contaminants are released from the solvent when it is returned to standard conditions.	No	Technology is still in the experimental stages.
	<u>Water Leaching.</u> Removal of water-soluble contaminants from soil by flushing with water. The water must be treated or disposed.	No	Organic contaminants are not readily soluble in water.
	SOLIDIFICATION, FIXATION, AND STABILIZATION Increase in solids content of waste by addition of sorbents, decrease in fluidity of mass by addition of lime or cement, or coating of individual particles or the entire mass in a protective jacket.	No	Considered to be a pretreatment step that would be analyzed in conjunction with other technologies.

TABLE 3-6 (Page 4 of 7)

General Response Action	Remedial Technology and Process Option	Retained for Further Analysis	Screening Comments
TREATMENT (cont'd)	<b>CHEMICAL TREATMENT</b>		
	<u>Neutralization.</u> Neutralization of solid wastes by the application of acids or bases.	No	Multi-contaminant wastes are inappropriate for neutralization due to potential for side reactions. pH extremes are not a concern.
	<u>Oxidation.</u> Chemical oxidation of contaminants by application of oxidizing agents. Generally used to treat organic compounds.	No	Oxidation is difficult to implement in a multi-contaminant situation due to the potential for side reactions, possibly explosive.
	<u>Reduction.</u> Chemical reduction of contaminants by application of reducing agents. Generally used to treat hexavalent chromium and other metals.	No	Reduction is difficult to implement in a multi-contaminant situation due to the potential for side reactions.
	<u>Other Chemical Modifications.</u> Chemical modification of contaminants rendering them inert. Treatments include hydrolysis, photolysis, catalysis, and others.	No	The large number of contaminants present would make implementation of these technologies difficult due to differing reactivities and chemical specificity of reagents.
	<b>BIOLOGICAL TREATMENT</b>		
	<u>New Biotechnologies.</u> Use of a controlled reactor utilizing modified micro-organisms selected for their ability to degrade and metabolize specific organic compounds. New biotechnologies include cultured micro-organisms, genetic engineered micro-organisms, and enzyme systems.	No	Can not treat coarse or fine fractions of soil mass; primarily for use on clean sands. Currently in developmental stage.
	<u>Land Treatment.</u> Utilization of the natural biological processes of soils and vegetation for stabilization and destruction of organic wastes. Processes include land farming and spray irrigation.	No	Difficult to obtain administrative approval due to potential for groundwater contamination, large area requirements, and public concern over introduction of NPL site wastes into uncontaminated areas.
	<u>Aerobic Biological Treatment - Composting.</u> Aerobic, thermophilic decomposition of organic solids by micro-organisms. Organic solids are placed in a pile or a reactor vessel and aerated by mechanical turning or by aeration headers buried in the solids.	No	Large volume of organic solids are not present. Most of the contaminated solids consist of soils containing VOC's, BNA's and heavy metals.
	<b>THERMAL TREATMENT</b>		
	<u>Incineration.</u> For a rotary kiln system, waste is injected into a horizontal, rotating, refractory-lined steel cylinder where it is incinerated at temperatures up to 2,000° F. Combustion gases are passed through an afterburner and scrubbed before release. Both conventional, permanent systems and mobile systems are available.	Yes	Viable alternative for treatment of all types of wastes present on site.

TABLE 3-6 (Page 5 of 7)

General Response Action	Remedial Technology and Process Option	Retained for Further Analysis	Screening Comments
TREATMENT (cont'd)	<u>Codisposal Processes.</u> Use of waste mixed with other combustible material as a supplemental fuel source for an existing industry. Includes the use of power generation boilers, cement kilns, lime kilns, and municipal sludge or refuse incinerators.	Yes	Viable alternative for highly combustible liquids (i.e., drummed waste). Not applicable to high ash content solids such as soil.
	<u>Pyrolysis.</u> Thermal liberation of volatile organic compounds in the absence of oxygen. Volatile gases released are burned in an afterburner. Applicable processes are conventional pyrolytic reactor and rotary hearth pyrolyzer.	No	Most of the specific technologies are more applicable to trash, sludges, or liquids.
IN-SITU TREATMENT			
	<u>Neutralization.</u> Application or injection of substances into the contaminated site to neutralize the pollutants present. Neutralizing agents are waste specific.	No	Multi-contaminant waste would be difficult to neutralize. Technique is not fully developed for use on contaminated soil or buried material.
	<u>Oxidation.</u> Degradation of oxidizable compounds by the addition of oxidizing agents or by the natural action of the soil.	No	Oxidizing agents may cause violent reactions when applied to multi-contaminant systems, and may mobilize metals.
	<u>Reduction.</u> Degradation of reducible compounds by the addition of reducing agents or by the natural action of the soil.	No	Difficult to assess the toxicity and potential mobility of reduction products, particularly in a complex, multi-contaminant system.
	<u>Bioreclamation.</u> Includes surface, subsurface, and bacterial augmentation systems. Degradation of hazardous chemicals by enhancing the biodegradation activity of native soil micro-organisms. Methods include manipulating oxygen, nutrient, and moisture content of the soil. Augmentation involves the addition of commercially available microbial cultures.	No	Low permeability of subsurface strata limits ability to control oxygen, nutrient, and moisture content. Surface bioreclamation alone does not satisfy MCP goals (subsurface waste could leach to groundwater).
	<u>Immobilization.</u> Immobilization of waste constituents within the soil mass by natural soil processes or the addition of immobilizing agents. Three major types of immobilization are sorption, ion exchange, and attenuation.	No	Technology is not fully developed and the long-term stability of immobilizing agent/waste constituent complexes is not known.
	<u>Polymerization.</u> Conversion of organic waste constituents to less mobile polymers by the addition of a catalyst and an activator.	No	Technology is still experimental.

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General Response Action	Remedial Technology and Process Option	Retained for Further Analysis	Screening Comments
TREATMENT	<u>Photolysis</u> . Degradation of photo-degradable organic constituents utilizing incident solar radiation. Soil generally requires mixing to increase solar exposure.	No	Only uppermost portion of the soil could be treated by this method. Photolysis may produce other hazardous compounds.
	<u>Vitrification</u> . Melting and solidification of the contaminated soil into a glass-like material by passing an electrical current through the soil. Gases omitted during the process are collected and treated.	Yes	Viable alternative for in-situ treatment. Contaminants not destroyed are permanently immobilized in vitrified mass.
	<u>Soil Vapor Extraction</u> . Application of a vacuum to wells or perforated pipe installed in the vadose zone. This creates an air flow through the soil which will strip VOC's.	No	Most effective on loose, sandy soils, which are dissimilar to those onsite. Applicable only to VOC's, which are not the major concern onsite; addresses no other contaminants. High groundwater level, low soil permeabilities and low VOC concentrations, would greatly hinder effectiveness of this method.
DISPOSAL	PRODUCT REUSE Sale and reuse of any wastes or waste derived products.	No	No economical products are foreseen. No defined market for hazardous waste derived materials from NPL site.
	ONSITE DISPOSAL		
	<u>RCRA Landfill</u> . Permanent storage facility on site, double lined with clay and a synthetic membrane liner and containing a leachate collection/detection system.	Yes	Viable alternative for onsite disposal.
	<u>Vault</u> . Disposal of contaminated solids in a concrete vault on site.	No	Acidic soil and contaminants would deteriorate concrete.
	<u>Unlined Landfill</u> . Replacement of treated solids into the excavation from which they were taken, covered by a multi-layer cap.	Yes	Viable alternative for materials treated on site.
	OFFSITE DISPOSAL		
	<u>RCRA Landfill</u> . Transport excavated soil or sediment to a RCRA approved landfill. May require dewatering or solidification prior to transport.	Yes	Viable alternative for solid wastes; however, this does not satisfy the goals of SARA.

TABLE 3-6 (Page 7 of 7)

General Response Action	Remedial Technology and Process Option	Retained for Further Analysis	Screening Comments
DISPOSAL (Cont'd)	<b>LAND APPLICATION</b> Incorporation of low-level solid hazardous wastes into the upper soil horizon where hazardous constituents are degraded by the natural action of the soil.	No	Difficult to obtain administrative approval due to potential for groundwater contamination, large area requirements, and public concern over the introduction of NPL sites wastes into uncontaminated areas.
OTHER MANAGEMENT OPTIONS	<b>RELOCATION OF RESIDENTS</b> Relocation of residents that are at a significant health risk. The affected home could be moved to a new site within the owner's property. Location to be determined later.	Yes	Viable alternative for residents directly exposed to site related contamination east of the site.



TABLE 3-7  
IDENTIFICATION OF APPLICABLE SURFACE WATER  
TECHNOLOGIES AND PROCESS OPTIONS  
SUMMIT NATIONAL FEASIBILITY STUDY

General Response Action	Remedial Technology and Process Option	Retained for Further Analysis	Screening Comments
NO ACTION	NONE Leave site as is.	Yes	The MCP requires No Action to be carried through to detailed analysis of alternatives. Health and environmental hazards make this a non-viable option.
ACCESS RESTRICTIONS	USE LIMITATIONS <u>Deed Restrictions.</u> All deeds for property within potentially contaminated areas would include restrictions on use of property.	Yes	Reduces exposure to contaminated surface water.
	<u>Site Fencing.</u> Fencing around the site and drainage ditches would be completed. All fencing would be maintained as necessary.	Yes	Viable alternative for reducing human and animal exposure to contaminated surface water.
	<u>Runoff Monitoring.</u> Collect and analyze storm water and sediment runoff to detect changes in runoff quality.	Yes	Viable alternative; however, not protective.
CONTAINMENT	SURFACE CONTROLS  <u>Grading.</u> Reshaping of the surface soil to eliminate ponds, and manage surface water infiltration and runoff while controlling erosion.	Yes	Viable alternative, when used in conjunction with capping.
	<u>Soil Stabilization.</u> Chemical binders and tacks are sprayed on bare soils or mulches to coat, penetrate and bind together the particles, thus reducing erosion and soil water loss and enhancing plant growth.	No	Does not address impounded surface water.
	<u>Revegetation.</u> Establish vegetative cover which will reduce erosion and contribute to the development of a naturally fertile and stable surface environment. Vegetation may be grasses, shrubs, legumes, or trees.	Yes	Viable alternative, particularly following the implementation of other remedial technologies such as capping or grading. Reduces runoff contact with contaminated surface soils.

TABLE 3-7 (Page 2 of 6)

General Response Action	Remedial Technology and Process Option	Retained for Further Analysis	Screening Comments
CONTAINMENT (cont'd)	<u>Diversion and Collection Systems.</u> Dikes, berms, ditches and trenches can be constructed along the perimeter of disturbed area to intercept storm runoff and divert the flow to natural or man-made drainageways, outlets, or sediment traps.	Yes	Viable alternative. Reduces volume of water flowing onto site.
	<u>Soil Cover.</u> Cover site with soil and establish vegetative cover.	Yes	Viable alternative. Reduces potential for erosion of contaminated soils which increases surface water contamination.
	<b>CAPPING</b> Process options are described in Table 3-5, Soil/Sediment/Subsurface Waste Technologies and Process Options.	Yes	Reduces or eliminates contamination of runoff/runoff. See Table 3-5 for additional screening comments.
COLLECTION	<b>BULK LIQUID REMOVAL</b>  Removal of bulk liquids located in ponds, lagoons, pits, tanks or drums by means of various physical methods, such as pumps, industrial vacuum, gravity siphon, dredges and bailing.	Yes	Water in onsite ponds must be removed by some method prior to treatment or disposal.
	<b>PHYSICAL TREATMENT</b>  <u>Activated Carbon Adsorption.</u> Passage of waste water containing up to 1% organics through a bed of activated carbon. Carbon adsorbs most organics and some metals.	Yes	Viable alternative for water treatment. Will require pretreatment to remove solids from the water.
TREATMENT	<u>Air (or Gas) Stripping.</u> Removal of volatile contaminants from a liquid by percolating air or other gas through the liquid. The volatile components are transferred from the liquid to the gas which is either treated or released to the atmosphere.	Yes	Viable alternative for removal of VOC's. Other treatments would be necessary for removal of BNA and inorganic parameters. May require laboratory or bench-scale investigation to tailor process to the specific situation.
	<u>Steam Stripping.</u> Removal of volatile contaminants from water by fractional distillation. Contaminated water enters the top of the distillation column and flows downward as steam rises through the column. Volatile components are transferred from the water to the steam which is either treated or released to the atmosphere.	Yes	Viable alternative for removal of VOC's. Other treatments would be necessary for removal of BNA and inorganic parameters. May require laboratory or bench-scale investigation to tailor process to the specific situation.

TABLE 3-7 (Page 3 of 6)

General Response Action	Remedial Technology and Process Option	Retained for Further Analysis	Screening Comments
TREATMENT (cont'd)	<u>Critical Fluid Extraction.</u> Extraction of organics from liquid wastes by forcing a solvent (generally CO <sub>2</sub> ) at its critical point through the waste. Organic components are transferred to the solvent. Contaminants are released from the solvent when it is returned to standard conditions.	No	Still in experimental stage.
	<u>Coagulation and Flocculation.</u> Addition of chemical agents to waste water which cause suspended particulates to aggregate. Improves efficiency of filtration, sedimentation, and flotation processes.	Yes	Viable alternative for treating water with a high concentration of suspended material.
	<u>Flotation.</u> Separation of suspended solids and free and emulsified oil and grease from water by floating them to the surface with gas bubbles and skimming off the froth.	Yes	Viable alternative for removing high concentrations of suspended material from water.
	<u>Cartridge Filtration.</u> Filtration of liquid through replaceable filter cartridges.	No	Volume of water ( 11,000 gals./day) is too great.
	<u>Liquid-Liquid Extraction.</u> Extraction of organics from an aqueous solution by forcing an immiscible organic solvent through the aqueous solution. Organics are transferred to the solvent.	No	Complete removal of organics cannot be achieved and extraction solvents are retained in water.
	<u>Distillation.</u> Concentration of volatile components of a liquid mixture by boiling and collecting and condensing the vapor.	No	Not applicable to complex or variable waste streams.
	<u>Evaporation.</u> Concentration of contaminants in water by evaporating off pure water.	No	Volatile contaminants tend to be evaporated with pure water. Concentrated stream requires further treatment.
	<u>Freeze Crystallization.</u> Removal of dissolved solids from a liquid by freezing and physically separating crystals from the solution. A concentrated contaminant solution is produced.	No	Process is still experimental.
	<u>Granular Media Filtration.</u> Filtration of liquid through a bed of granular material.	Yes	Viable alternative for removing suspended solids from waste water.
	<u>Molecular Sieves.</u> Passage of waste water over synthetically produced anhydrous metal-alumino-silicates which adsorb contaminant molecules. Uniform and controllable pore-size of the adsorbant allows high selectivity of molecules adsorbed.	No	Molecular sieves are highly selective for molecule size. The surface water contains a wide range of contaminants of various molecular sizes, and thus is not suitable for this treatment.

TABLE 3-7 (Page 4 of 6)

General Response Action	Remedial Technology and Process Option	Retained for Further Analysis	Screening Comments
TREATMENT (cont'd)	<u>Membrane Processes.</u> Separation of components of a mixture or solution by employing some driving force across a barrier membrane which will preferentially pass certain components. These processes produce two streams; one concentrated and one dilute. Specific processes include electrodialysis, reverse osmosis, dialysis, and ultra filtration.	No	Membrane processes are contaminant specific and would not be well suited for a multi-contaminant situation.
CHEMICAL TREATMENT			
	<u>Precipitation.</u> Precipitation of metals as sulfides, carbonates, phosphates, and hydroxides by the addition of the appropriate precipitant, such as lime.	Yes	Viable method for removal of metals detected in surface water. Necessary as pre-treatment before carbon adsorption to prevent fouling of activated carbon.
	<u>Neutralization.</u> Application of substances into the contaminated water to neutralize the pollutants present. Neutralizing agents are waste specific.	No	Multi-contaminant wastes are inappropriate for neutralization due to potential for side reactions. pH is not a concern.
	<u>Oxidation.</u> Degradation of oxidizable compounds by the addition of oxidizing agents.	No	Oxidation is difficult to implement in a multi-contaminant situation due to the potential for side reactions, some possibly explosive.
	<u>Reduction.</u> Degradation of reducible compounds by the addition of reducing agents.	No	Reduction is difficult to implement in a multi-contaminant situation due to the potential for side reactions.
BIOLOGICAL TREATMENT			
	<u>Aerobic Processes.</u> Waste stream placed in a controlled environment such as a compost pile with the addition of air to aid microbial degradation of organics.	Yes	May be applicable for some base neutrals; however, low concentrations may be difficult to treat. Metals would accumulate in waste sludge.
	<u>Anaerobic Processes.</u> Waste stream placed in a controlled and enclosed environment such as a digester, to allow microbial degradation in the absence of oxygen.	Yes	Viable alternative for treating contaminated water.

TABLE 3-7 (Page 5 of 6)

General Response Action	Remedial Technology and Process Option	Retained for Further Analysis	Screening Comments
TREATMENT (cont'd)	<u>Facultative and Fermentation Processes.</u>		
	Facultative Ponds. Waste water flows through earthen ponds containing a suspended culture. The ponds are not artificially aerated so that an aerobic zone forms at the top and an anaerobic zone at the bottom. Between these zones is the facultative zone.	No	Temperature is difficult to control due to regional climate.
	Fermentation. Organic waste acts as an electron acceptor for energy-yielding, biologically mediated redox reactions.	No	Difficult to maintain the pure culture required due to the multi-contaminant nature of the waste.
	<u>New Biotechnologies.</u>		
	Use of cultured or genetically modified micro-organisms selected for their ability to degrade and metabolize specific organic compounds. New biotechnologies include cultured micro-organisms, genetic engineered micro-organisms, and enzyme systems.	Yes	Viable for removal of organics. Would require pretreatment to remove solids and metals.
	THERMAL TREATMENT		
	<u>Incineration Technologies.</u> Thermal destruction by use of a rotary kiln, multiple hearth, plasma arc, fluidized bed, molten salt, infrared or electric arc.	No	Not applicable to destruction of low level organic contaminants in water. Majority of energy would be expended in vaporizing water.
DISPOSAL	PRODUCT REUSE		
	Sale and reuse of any wastes or waste derived products.	No	No economical products are foreseen. No defined market for hazardous waste derived materials from NPL site.
	STORAGE		
	<u>Surface Impoundments.</u> Storage of liquid or sludge wastes in earthen impoundments. Generally a temporary action.	No	Not a permanent disposal alternative; does not meet goals of NCP.
	<u>Storage in Containers.</u> Storage of liquid waste in tanks, drums, or other containers. Generally a temporary action.	No	Not a permanent disposal alternative; does not meet goals of NCP.

TABLE 3-7 (Page 6 of 6)

General Response Action	Remedial Technology and Process Option	Retained for Further Analysis	Screening Comments
DISPOSAL (cont'd)	WASTE WATER DISCHARGE		
	<u>Discharge to Public Owned Treatment Works.</u> Discharge of low-level aqueous waste to POTWs for treatment.	Yes	Viable alternative. Contact with POTW's indicate it will be difficult to obtain authorization from local authorities due to public concern regarding the NPL site wastes.
	<u>Discharge to Deep Injection Wells.</u> Disposal of hazardous fluids to the deep subsurface (below the lowermost formation containing an underground source of drinking water) by means of deep (Class I) injection wells.	Yes	Viable alternative.
	<u>Discharge to Shallow Wells.</u> Disposal of non-hazardous fluids to the subsurface by means of shallow (Class V) injection wells.	No	Underground Injection Control Program will not permit discharge of treated hazardous materials to shallow groundwater.
	<u>Discharge to Surface Water.</u> Disposal of aqueous waste containing very low levels of contaminants to streams.	Yes	Viable alternative for treated water. Requires compliance with NPDES standards.
	<u>Discharge to RCRA Facility.</u> Discharge to RCRA licensed facility for treatment and disposal.	Yes	Viable alternative.
	LAND APPLICATION		
	Incorporation of low-level liquid hazardous wastes into the upper soil horizon where hazardous constituents are degraded by the natural action of the soil.	No	Difficult to obtain administrative approval due to potential for groundwater contamination, large land area needed, and public concern over the introduction of NPL site wastes into uncontaminated areas.
OTHER MANAGEMENT OPTIONS	RELOCATION OF RESIDENTS		
	Relocation of residents that are at a significant health risk. The affected houses could be moved to a new site within the owner's property. Location to be determined later.	Yes	Viable alternative for residents directly adjacent to the site. Onsite ponds discharge surface water to the east.

TABLE 3-8  
IDENTIFICATION OF APPLICABLE GROUNDWATER AND ASSOCIATED FREE PRODUCT TECHNOLOGIES AND PROCESS OPTIONS  
TECHNOLOGIES AND PROCESS OPTIONS  
SUMMIT NATIONAL FEASIBILITY STUDY

General Response Action	Remedial Technology and Process Option	Retained for Further Analysis	Screening Comments
NO ACTION	NONE Leave site as is.	Yes	The NCP requires No Action to be carried through to detailed analysis of alternatives. Health and environmental hazards make this a non-viable option.
ACCESS RESTRICTIONS	USE LIMITATIONS <u>Deed Restrictions</u> . All deeds for property within potentially contaminated areas would include restrictions on groundwater.  <u>Groundwater Monitoring</u> . Monitor groundwater from existing wells to detect changes in groundwater chemistry that may indicate movement of contaminants.	Yes  Yes	Viable alternative for reducing exposure to contaminated groundwater.  Viable alternative. All potentially affected aquifers should be monitored.
CONTAINMENT	CAPPING Process options are described in Table 3-5, Soil/Sediment/Subsurface Waste Technologies and Process Options.  VERTICAL BARRIERS  <u>Soil-Bentonite Slurry Wall</u> . Trench is excavated around site and backfilled with soil-bentonite mix.  <u>Cement-Bentonite Slurry Wall</u> . Trench is excavated around site and backfilled with cement-bentonite mix.  <u>Vibrating Beam Wall</u> . H-piles equipped with injection pipes are driven into the ground and removed. Grout is injected as the pile is removed. A continuous wall of grout is produced by successive driving and removal of piles.  <u>Grout Curtain</u> . Grout is injected into ground from rows of wells to produce a continuous wall of grout.  <u>Sheet Pile Wall</u> . Steel sheet piles are driven into the ground with a vibratory hammer and connected at the ends to provide a continuous vertical wall.	Yes  No  No  No  No	See Table 3-5 for screening comments.  Viable alternative for minimizing lateral migration of contaminated groundwater.  Sufficiently low permeability cannot be achieved. Acidic soil could deteriorate cement.  Difficult to ensure integrity of wall, leakage through wall common. H-piles could be deflected by rubble in the mine spoil.  Difficult to ensure integrity of wall, leakage through wall common.  Joints tend to leak. Acidic, saline groundwater would cause corrosion. Sheet piles could be deflected by rubble in the mine spoil.

TABLE 3-8 (Page 2 of 8)

General Response Action	Remedial Technology and Process Option	Retained for Further Analysis	Screening Comments
CONTAINMENT (cont'd)	<u>Permeability Reducing Agents.</u> Injection of chemical agent into soil to reduce soil matrix permeability.	No	Undeveloped technology. Currently only at the theoretical stage of development.
	<u>Ground Freezing.</u> Coolant circulated through refrigeration pipes placed in adjacent boreholes freezes the soil forming a vertical wall.	No	Should be considered as a temporary solution due to high energy requirement for sustained use. Does not meet long-term goals of the NCP.
	<b>HORIZONTAL BARRIERS</b> Use of block displacement or injection grouting to reduce downward migration of contaminants into saturated zone.	No	Use of block displacement and injection grouting is experimental and unproven for producing horizontal barriers.
COLLECTION	<b>EXTRACTION</b>		
	<u>Wells.</u> Remove contaminated groundwater by means of wells, such as wellpoints, suction wells, and injection well systems. Well skimmers would also be employed for collection of free product.	Yes	Viable alternative for more permeable regions of the water table aquifer. Pumping of other contaminated aquifers is impractical due to very low permeability.
	<u>Drains.</u> Collect and remove contaminated groundwater by means of french drains, tile drains, or dual media drains.	Yes	Viable alternative for removal of contaminated groundwater from low permeability strata.
	<u>Radial Collection Wells.</u> Removal of groundwater by means of well screens driven horizontally from caissons.	Yes	Viable alternative for collection of groundwater from unconsolidated material.
	<b>ENHANCED REMOVAL</b>		
	<u>Solution Mining.</u> Elutriation of waste constituents from contaminated soil for recovery and treatment. Flushing solutions include water, acidic and basic aqueous solutions, solvents and surfactants.	No	Difficult to inject and recover solution from soils with low permeability.
	<u>Thermal Enhanced Oil Recovery.</u> Injection of hot water, air, or steam to reduce the viscosity of heavy oils, increasing the mobility of the production wells. Technology developed as an oil field production technique.	No	Use in unconfined aquifers or geologic units has not been demonstrated. Increased mobility of oil may increase extent of contamination.



TABLE 3-8 (Page 3 of 8)

General Response Action	Remedial Technology and Process Option	Retained for Further Analysis	Screening Comments
COLLECTION (cont'd)	<u>Chemical Enhanced Oil Recovery.</u> Injection of chemical solutions into an oil reservoir in order to decrease the mobility ratio between the oil and the displacing fluid. This allows more effective displacement of the oil.	No	Use in unconfined aquifers or geologic units has not been demonstrated. Increased mobility of oil may increase extent of contamination.
TREATMENT	PHYSICAL TREATMENT		
	<u>Oil-Water Separation.</u> Separation of oil from water by means of gravity settling, filtration, carbon adsorption, or coalescing methods. Emulsions generally must be broken down by chemical or thermal treatment.	Yes	Viable alternative for treating "free product" associated with shallow groundwater.
	<u>Activated Carbon Adsorption.</u> Passage of waste water containing up to 1% organics through a bed of activated carbon. Carbon adsorbs most organics and some metals.	Yes	Viable alternative for water treatment. Will require pretreatment to remove solids from the water.
	<u>Air (or Gas) Stripping.</u> Removal of volatile contaminants from a liquid by percolating air or other gas through the liquid. The volatile components are transferred from the liquid to the gas which is either treated or released to the atmosphere.	Yes	Viable alternative for removal of VOC's. Other treatments would be necessary for removal of BNA and inorganic parameters. May require laboratory or bench-scale investigation to tailor process to the specific situation.
	<u>Steam Stripping.</u> Removal of volatile contaminants from water by fractional distillation. Contaminated water enters the top of the distillation column and flows downward as steam rises through the column. Volatile components are transferred from the water to the steam which is either treated or released to the atmosphere.	Yes	Viable alternative for removal of VOC's. Other treatments would be necessary for removal of BNA and inorganic parameters. May require laboratory or bench-scale investigation to tailor process to the specific situation.
	<u>Critical Fluid Extraction.</u> Extraction of organics from liquid or solid wastes by forcing a solvent (generally CO <sub>2</sub> ) at its critical point through the waste. Organic components are transferred to the solvent. Contaminants are released from the solvent when it is returned to standard conditions.	No	Still in experimental stage.

TABLE 3-8 (Page 4 of 8)

General Response Action	Remedial Technology and Process Option	Retained for Further Analysis	Screening Comments
TREATMENT (cont'd)	<u>Coagulation and Flocculation.</u> Addition of chemical agents to waste water which cause suspended particulates to aggregate. Improves efficiency of filtration, sedimentation, and flotation processes.	Yes	Viable alternative for treating water with a high concentration of suspended material.
	<u>Flotation.</u> Separation of suspended solids and free and emulsified oil and grease from water by floating them to the surface with gas bubbles and skimming off the froth.	Yes	Viable alternative for removing high concentrations of suspended material from water.
	<u>Cartridge Filtration.</u> Filtration of liquid through replaceable filter cartridges.	No	Volume of water (approximately 11,000 gals./day) is too large.
	<u>Liquid-Liquid Extraction.</u> Extraction of organics from an aqueous solution by forcing an immiscible organic solvent through the aqueous solution. Organics are transferred to the solvent.	No	Complete removal of organics cannot be achieved and extraction solvents are retained in water.
	<u>Distillation.</u> Concentration of volatile components of a liquid mixture by boiling and collecting and condensing the vapor.	No	Not applicable to complex or variable waste streams.
	<u>Evaporation.</u> Concentration of contaminants in water by evaporating off pure water.	No	Volatile contaminants tend to be evaporated with pure water. Concentrated stream requires further treatment.
	<u>Freeze Crystallization.</u> Removal of dissolved solids from a liquid by freezing and physically separating crystals from the solution. A concentrated contaminant solution is produced.	No	Process is still experimental.
	<u>Granular Media Filtration.</u> Filtration of liquid through a bed of granular material.	Yes	Viable alternative for removing suspended solids from waste water.
	<u>Molecular Sieves.</u> Passage of waste water over synthetically produced anhydrous metal-alumino-silicates which adsorb contaminant molecules. Uniform and controllable pore-size of the adsorbant allows high selectivity of molecules adsorbed.	No	Molecular sieves are highly selective for molecule size. The groundwater contains a wide range of contaminants of various molecular sizes, and thus is not suitable for this treatment.

TABLE 3-8 (Page 5 of 8)

General Response Action	Remedial Technology and Process Option	Retained for Further Analysis	Screening Comments
TREATMENT (cont'd)	<u>Membrane Processes.</u> Separation of components of a mixture or solution by employing some driving force across a barrier membrane which will preferentially pass certain components. These processes produce two streams; one concentrated and one dilute. Specific processes include electrodialysis, reverse osmosis, dialysis, and ultra filtration.	No	Membrane processes are contaminant specific and would not be well suited for a multi-contaminant situation.
CHEMICAL TREATMENT			
	<u>Precipitation.</u> Precipitation of metals as sulfides, carbonates, phosphates, and hydroxides by the addition of the appropriate precipitant, such as lime.	Yes	Viable method for removal of metals detected in groundwater. Necessary as pre-treatment before carbon adsorption to prevent fouling of activated carbon.
	<u>Neutralization.</u> Application of substances into the contaminated water to neutralize the pollutants present. Neutralizing agents are waste specific.	No	Multi-contaminant wastes are inappropriate for neutralization due to potential for side reactions. pH extremes are not a concern.
	<u>Oxidation.</u> Degradation of oxidizable compounds by the addition of oxidizing agents.	No	Oxidation is difficult to implement in a multi-contaminant situation due to the potential for side reactions, some possibly explosive.
	<u>Reduction.</u> Degradation of reducible compounds by the addition of reducing agents.	No	Reduction is difficult to implement in a multi-contaminant situation due to the potential for side reactions.
BIOLOGICAL TREATMENT			
	<u>Aerobic Processes.</u> Waste stream placed in a controlled environment such as a compost pile with the addition of air to aid microbial degradation of organics.	Yes	May be applicable for some base neutrals; however, low concentrations may be difficult to treat. Metals would accumulate in waste sludge.

TABLE 3-8 (Page 6 of 8)

General Response Action	Remedial Technology and Process Option	Retained for Further Analysis	Screening Comments
TREATMENT (cont'd)	<p><u>Anaerobic Processes.</u> Waste stream placed in a controlled and enclosed environment such as a digester, to allow microbial degradation in the absence of oxygen.</p> <p><u>Facultative and Fermentation Processes.</u></p> <p>Facultative Ponds. Waste water flows through earthen ponds containing a suspended culture. The ponds are not artificially aerated so that an aerobic zone forms at the top and an anaerobic zone at the bottom. Between these zones is the facultative zone.</p> <p>Fermentation. Organic waste acts as an electron acceptor for energy-yielding, biologically mediated redox reactions.</p> <p><u>New Biotechnologies.</u></p> <p>Use of cultured or genetically modified micro-organisms selected for their ability to degrade and metabolize specific organic compounds. New biotechnologies include cultured micro-organisms, genetic engineered micro-organisms, and enzyme systems.</p>	<p>Yes</p> <p>No</p> <p>No</p> <p>Yes</p>	<p>Viable alternative for treating contaminated water.</p> <p>Temperature is difficult to control due to regional climate.</p> <p>Difficult to maintain the pure culture required due to the multi-contaminant nature of the waste.</p> <p>Viable for removal of organics. Would require pretreatment to remove solids and metals.</p>
	THERMAL TREATMENT		
	<p><u>Incineration Technologies.</u> Thermal destruction by use of a rotary kiln, multiple hearth, plasma arc, fluidized bed, molten salt, infrared or electric arc.</p>	No	Not applicable to destruction of low level organic contaminants in water. Majority of energy would be expended in vaporizing water.
	IN-SITU TREATMENT		
	<p><u>Bioreclamation.</u></p> <p>Aquifer Bioreclamation. Degradation of hazardous chemicals by enhancing the biodegradation activity of soil micro-organisms. Methods include manipulating oxygen and nutrient content of the soil, and addition of microbial cultures.</p>	No	Injection of oxygenated water and nutrients would increase head, thereby increasing potential for downward migration of contaminated groundwater.

TABLE 3-8 (Page 7 of 8)

General Response Action	Remedial Technology and Process Option	Retained for Further Analysis	Screening Comments
TREATMENT (cont'd)	<u>Immobilization.</u> Immobilization of waste constituents within the soil mass by natural soil processes or the addition of immobilizing agents. Three major types of immobilization are sorption, ion exchange, and attenuation.	No	Technology is not fully developed and the long-term stability of immobilizing agent/waste constituent complexes is not known.
	<u>Neutralization.</u> Application or injection of substances into the contaminated site to neutralize the pollutants present. Neutralizing agents are waste specific.	No	Multi-contaminant waste would be difficult to neutralize. Technique is not fully developed for use on contaminated soil or buried material.
	<u>Oxidation.</u> Degradation of oxidizable compounds by the addition of oxidizing agents or by the natural action of the soil.	No	Oxidizing agents may cause violent reactions when applied to multi-contaminant systems, and may mobilize metals.
	<u>Reduction.</u> Degradation of reducible compounds by the addition of reducing agents or by the natural action of the soil.	No	Difficult to assess the toxicity and potential mobility of reduction products, particularly in a complex, multi-contaminant system.
	<u>Precipitation.</u> Precipitation of metals as sulfides, carbonates, phosphates, and hydroxides by the addition of the appropriate salt.	No	Salts added to precipitate metals may increase site contamination. Sulfide precipitation may produce hydrogen sulfide gas.
	<u>Polymerization.</u> Conversion of organic waste constituents to less mobile polymers by the addition of a catalyst and an activator.	No	Technology is still experimental.
	<u>Photolysis.</u> Degradation of photo-degradable organic constituents utilizing incident solar radiation.	No	Many site contaminants are not photo-degradable.
DISPOSAL	<u>Permeable Treatment Beds.</u> Treatment of shallow groundwater as it flows through an intercepting trench filled with an appropriate treatment material.	No	Technology is still in the conceptual stage of development.
	WASTE WATER DISCHARGE		
	<u>Discharge to Public Owned Treatment Works.</u> Discharge of low-level aqueous waste to POTWs for treatment.	Yes	Viable alternative. May be difficult to obtain authorization from local authorities due to public concern regarding NPL site wastes.

TABLE 3-8 (Page 8 of 8)

General Response Action	Remedial Technology and Process Option	Retained for Further Analysis	Screening Comments
DISPOSAL (cont'd)	<u>Discharge to Deep Injection Wells.</u> Disposal of hazardous fluids to the deep subsurface (below the lowermost formation containing an underground source of drinking water) by means of deep (Class I) injection wells.	Yes	Viable alternative.
	<u>Discharge to Shallow Wells.</u> Disposal of non-hazardous fluids to the subsurface by means of shallow (Class V) injection wells.	No	Viable alternative for treated water. Underground Injection Control Program will not permit discharge of treated hazardous materials to shallow groundwater.
	<u>Discharge to Surface Water.</u> Disposal of aqueous waste containing very low levels of contaminants to streams.	Yes	Viable alternative for treated water. Requires compliance with NPDES standards.
	<u>Discharge to RCRA Facility.</u> Discharge extracted groundwater to RCRA licensed facility for treatment and disposal.	Yes	Viable alternative.
	<b>PRODUCT REUSE</b> Sale and reuse of any wastes or waste derived products.	No	No economical products are foreseen. No defined market for hazardous waste derived materials from NPL site.
	<b>LAND APPLICATION</b> Incorporation of low-level solid hazardous wastes into the upper soil horizon where hazardous constituents are degraded by the natural action of the soil.	No	Difficult to obtain administrative approval due to potential for groundwater contamination, large area requirements, and public concern over introduction of NPL site wastes into uncontaminated areas.
OTHER MANAGEMENT OPTIONS	<b>ALTERNATIVE DRINKING WATER SOURCES</b> Development of an alternative drinking water source in areas where current supply is contaminated.	Yes	Viable alternative if groundwater contamination affects residential wells in future.
	<b>INDIVIDUAL HOME TREATMENT UNITS</b> Small-scale treatment of drinking water at individual homes.	Yes	Viable alternative if groundwater contamination affects residential wells in future.
	<b>RELOCATION OF RESIDENTS</b> Relocation of residents that are at a significant health risk. The affected home could be moved to a new site within the owner's property. Location to be determined later.	Yes	Groundwater previously used as a drinking water source at house east of source.

## CHAPTER 4

### SCREENING OF APPLICABLE REMEDIAL TECHNOLOGIES

#### 4.1 INTRODUCTION

Applicable remedial technologies, carried forward from Chapter 3, are screened in this chapter to evaluate their use in potential remedial actions based on:

- Effectiveness: Effectiveness is defined as the ability of a technology to meet environmental and public health standards specified by the State of Ohio and USEPA. Also considered in evaluating effectiveness are reliability (i.e., probability of success or failure based on previous use of the technology in similar situations, complexity and frequency of operation and maintenance procedures) and safety (i.e., the short term and long term threat to nearby communities and the environment, as well as workers). In the absence of standards or guidance, performance specifications are considered for evaluating alternative technologies. Technologies that do not effectively contribute to the protection of public health, welfare, or the environment will not be considered further. Technologies posing significant adverse environmental effects and very limited environmental benefits will also be excluded.
- Implementability: Technologies must be implementable and maintainable according to acceptable engineering practices. This includes evaluation of the ability of each technology to meet remedial action objectives in terms of technical feasibility, availability of the proposed technologies, time required for installation, time before desired results are obtained, and administrative requirements.
- Costs: Costs are used in the technology screening for comparative purposes to distinguish between technologies exhibiting similar effectiveness and implementability. When several technologies addressing the same response action are determined to be equally beneficial, the technology having

the lower relative cost will be retained and the costlier technologies eliminated from further consideration. Costs are not used here to discriminate among treatment and non-treatment technologies. Costs presented in this section are present worth costs, including contingencies.

#### 4.2 OVERVIEW OF APPLICABLE REMEDIAL TECHNOLOGIES

Table 4-1 summarizes the applicable remedial technologies for soil, sediment, subsurface waste, surface water, and groundwater and associated free product carried forward from Chapter 3. Auxiliary processes that may be necessary for proper implementation of a remedial action, such as storage for groundwater treatment, are not included in this table.

Some of these remedial technologies are used in more than one of the operable units, as indicated in Table 4-1. To avoid a repetitive analysis, the technologies applicable to more than one operable unit will be discussed only once. Sediment and subsurface wastes have been combined with soil as an operable unit because remediation of contaminated sediment, contaminated soil, and subsurface waste should satisfy the same remedial action goals.

Screening of applicable remedial technologies is used to select those that are most appropriate to the Summit National Site's remedial action goals and conditions. Technologies are screened relative to other technologies within the same general response action. This screening process evaluates major effects and does not rely wholly on quantification to be effective in identifying and eliminating less feasible technologies.

Costs are incorporated in this step where effectiveness and implementability criteria are not sufficient to distinguish between technologies and where sufficient detail is available to develop order-of-magnitude cost estimates. These estimates are used to eliminate those alternatives whose costs are significantly greater than competing alternatives, yet do not provide significantly greater environmental and public health benefits. The important focus here is to have comparative estimates for alternatives with equal relative accuracy for this level of screening. Cost estimates of technologies or process options will be refined as the level of detail of the cost estimates



TABLE 4-1  
APPLICABLE REMEDIAL TECHNOLOGIES  
SUMMIT NATIONAL FEASIBILITY STUDY

Applicable Remedial Technologies	Soil/Sediment/ Subsurface Waste	Surface Water	Groundwater/ Free Product
NO ACTION	X	X	X
ACCESS RESTRICTIONS			
Deed Restrictions	X	X	X
Site Fencing	X	X	
Runoff Monitoring	X	X	
Groundwater Monitoring			X
CONTAINMENT			
Surface Controls			
Grading		X	
Revegetation	X	X	
Diversion and Collection Systems		X	
Soil Cover	X	X	
Capping			
Single Layer	X	X	X
Multi-Layer	X	X	X
Vertical Barriers			
Soil-Bentonite Slurry Wall			X
REMOVAL			
Excavation/Demolition			
Drum, Tank and Debris Removal	X		
Mechanical Excavation	X		
Sediment Excavation	X		
Structure Demolition	X		
COLLECTION			
Extraction			
Extraction Wells			X
Drains			X
Radial Collection Wells			X
Bulk Liquid Removal		X	

TABLE 4-1 (cont'd)  
Page 2

Applicable Remedial Technologies	Soil/Sediment/ Subsurface Waste	Surface Water	Groundwater/ Free Product
<b>TREATMENT</b>			
Physical Treatment			
Oil-Water Separation			X
Activated Carbon Adsorption		X	X
Air or Gas Stripping		X	X
Steam Stripping		X	X
Coagulation/Flocculation/ Sedimentation		X	X
Flotation		X	X
Granular Media Filtration		X	X
Chemical Treatment			
Precipitation		X	X
Biological Treatment			
Aerobic		X	X
Anaerobic		X	X
New Biotechnologies		X	X
Thermal Treatment			
Rotary Kiln Incineration	X		
Co-Disposal	X		
In-Situ Treatment			
Vitrification	X		
<b>DISPOSAL</b>			
Onsite Disposal			
RCRA Landfill	X		
Unlined Landfill	X		
Offsite Disposal			
RCRA Landfill	X		
Wastewater Discharge			
POTW		X	X
Deep Injection Wells		X	X
Discharge to Surface Water		X	X
RCRA Facility		X	X
<b>OTHER MANAGEMENT OPTIONS</b>			
Alternative Drinking Water Sources			X
Individual Home Treatment Units			X
Resident Relocation	X	X	X

increases beyond the screening process. Order-of-magnitude cost estimates have been prepared for capital and annual operation and maintenance costs. The total estimated cost for a technology or process option includes the capital cost and the present worth (30-year economic life, 10-percent interest) of operation and maintenance costs with contingencies.

Technologies and process options are described and costs, where necessary, are presented under each general response action of the operable units.

#### 4.3 SOIL, SEDIMENT, AND SUBSURFACE WASTE OPERABLE UNIT

Soil, sediment, and subsurface waste general response actions, applicable technologies, and process options are presented in the previous chapter in Figure 3-1 and presented on Table 3-6.

##### 4.3.1 No Action

The NCP requires No Action to be carried through detailed analysis of alternatives.

##### 4.3.2 Access Restrictions

The purpose of access restrictions is to prevent exposure of receptors to contaminants by limiting receptor access to contaminated soil, sediment, and subsurface wastes. Three use restriction options are applicable for this site to limit access: deed restrictions, site fencing, and runoff monitoring. Runoff monitoring is applicable only to contaminated soils and sediments, not subsurface waste. Deed restrictions may be used to prevent future construction activity on site or in contaminated areas adjacent to the site. Relocation and extension of the existing site fencing could be used to prevent direct contact with the on site contaminants at relatively low cost. The fence would be relocated approximately 100 ft. south and 150 ft. east of its current location along the eastern and southern boundaries, respectively. This would enclose identified contaminated areas within the fence and could provide some additional area to the east of the site for staging remedial action operations. The anticipated cost of relocating and extending the existing fence, including purchase of approximately 4 acres, is \$72,000, and about \$2,000 is

expected to be required to administer other access restrictions, such as warning signs. All runoff is discharged from the site at the southeast corner. Two sample sets per quarter could be collected from this location and a full HSL scan performed to monitor the quality of water leaving the site. The present worth cost for quarterly sampling and analysis of site runoff is \$150,000. These technologies will be retained for assembly of alternatives.

#### 4.3.3 Containment

Applicable technologies for containment of contaminated soil, sediment, and subsurface waste include use of surface controls, and capping.

- a. Surface Controls: Two surface control technologies could be used together to stabilize soil and sediment and to limit or eliminate direct receptor contact with contaminated soil, sediment and subsurface waste. Addition of a 2-foot soil cover, and revegetation would reduce erosion and limit migration of contaminated soil off site, reduce the potential for surface water contamination, and prevent direct contact with contaminated surface soil, sediments, and subsurface waste. Soil cover without revegetation would not, however, reduce the leaching of soil contaminants and subsurface wastes to the groundwater. This constitutes a serious potential hazard, as buried drums and tanks are a major onsite contaminant source and groundwater from the Upper Intermediate Unit (which is hydraulically connected with the Water Table Aquifer) provides drinking water for the region. On the basis of this risk, soil cover will be eliminated from further consideration. Revegetation can be used effectively in conjunction with other technologies such as capping, and will be retained for alternative assembly. The estimated present worth cost of revegetation, including annual maintenance is \$46,000, based on a 30 year life. The area to be revegetated includes the extended site boundary. Total area is approximately 15.5 acres.
- b. Capping: The placement of a cap over the contaminated areas of the site would provide more reliable containment than that provided by the 2 ft. soil cover proposed in the surface controls discussion and would also reduce surface

infiltration, thereby reducing the amount of contaminants leaching to the groundwater. Two types of caps were retained after the initial screening in Chapter 3: the single layer and multilayer caps.

A single layer cap consisting of an impervious layer of clay or soil admixture would be susceptible to cracking and leakage due to natural freeze/thaw cycles and desiccation (EPA Handbook, Remedial Action at Waste Disposal Sites, October 1985, Section 3.1.3.2). Since reduction of infiltration is an important function of the cap, and since this process option cannot adequately achieve this goal, the single layer cap will be eliminated from further consideration.

A multi-layer cap satisfying the recommendations of EPA in the RCRA Guidance Document was also analyzed (RCRA Guidance Document, Surface Impoundments, Liner Systems and Freeboard Control, July 1982). The multilayer cap includes, from top to bottom, 1 ft. of topsoil-like loam overlying 1 ft. of clean earth fill to retard root penetration. This layer is underlain by a synthetic drainage net constructed of High Density Polyethylene (HDPE) which will convey infiltration out of the vegetation support zone (upper 24 inches). Below the drainage net is a 40 mil HDPE synthetic membrane underlain by a 2 ft. thick compacted clay layer. A typical cross-section of the cap is included as Figure 4-1.

Maintenance requirements for the cap would include repair of erosion to the uppermost soil layers. Differential settlement of the cap should not be a problem as it will be constructed on native soil and strip mine spoils that have been in place for at least 15 years. The surface of the contaminated materials and any materials used for site grading would be compacted prior to cap construction. If settlement does occur, the effectiveness of the multi-layer cap would not be compromised due to the flexibility of the HDPE liner (13% elongation at yield, 700% elongation at break - manufacturer specifications), and the self-healing properties of the clay liner.

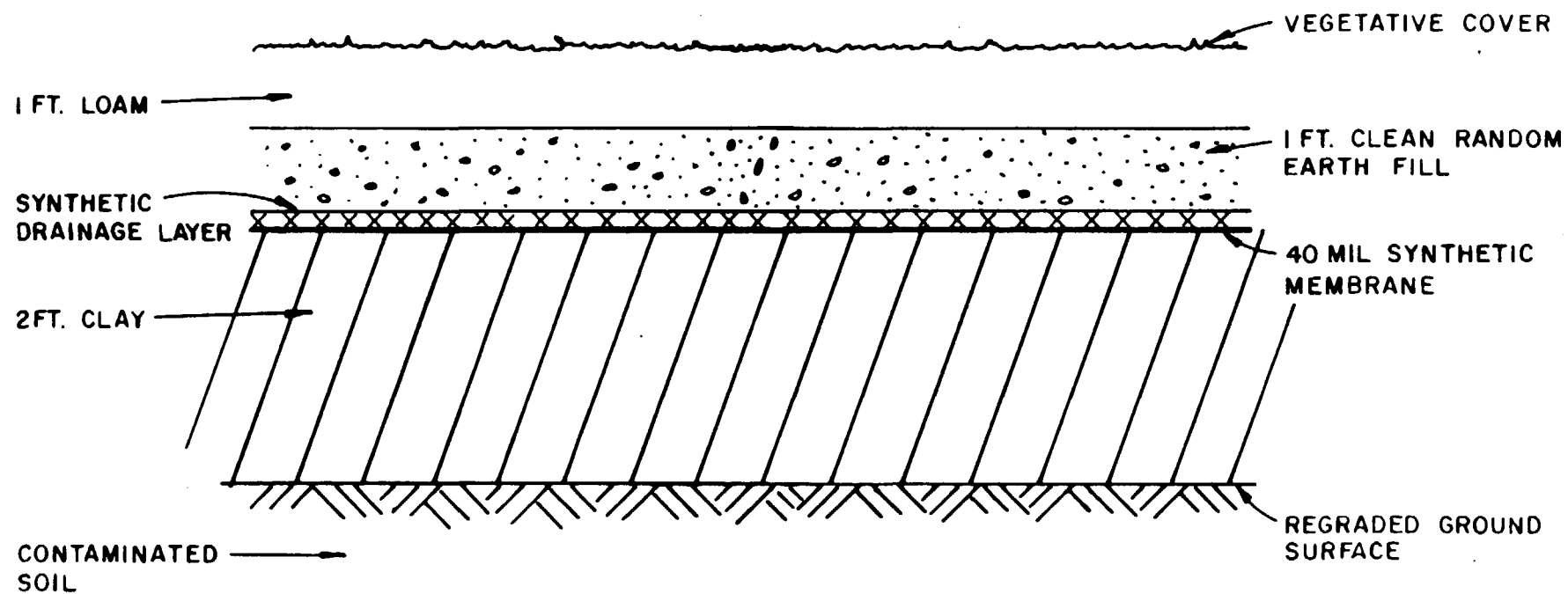


FIGURE 4-1  
MULTI-LAYER CAP  
SUMMIT NATIONAL FS

For this FS, it has been estimated that:

- Every 10 years about 30% of the topsoil-like loam must be replaced and regraded.
- Every 10 years the vegetative cover must be replaced.
- Assuming proper maintenance is provided, the life of the synthetic liner will exceed 30 years.

The cap is considered effective in limiting migration of contaminated solids offsite, and preventing direct contact with contaminated solids, provided that regular maintenance is performed. Seasonal lawn maintenance is considered necessary to ensure erosion control, and monitoring of groundwater and runoff would be required to assess cap performance. Monitoring technologies are addressed separately for groundwater and surface water operable units.

The reliability of the cap in controlling infiltration to the landfill is estimated to be high, assuming proper construction and long-term maintenance. It is not likely to be diminished by cracks or breaks in the low permeability layers caused by settlement of soils. Cost allowances have been included for regular maintenance, and it is likely that it will result in continued effective performance of the cap throughout the estimated 30-year useful life. The cost of the multi-layer capping option is approximately \$3,700,000, including the present worth value of operational and maintenance costs. This cost includes grading and revegetation. The multilayer option will be retained for alternative assembly.

#### 4.3.4 Removal

Various options were considered for the removal of contaminated solids and for the demolition of onsite structures. The considered options included: removal of buried drums, tanks, and other debris; partial mechanical excavation of portions of the most highly contaminated soil ("hot spot soil"); partial mechanical excavation of contaminated soil over the entire site (vadose zone only, maximum depth of 8 ft.); total mechanical excavation of contaminated soil (to bedrock,

maximum depth of 40 ft., includes removal of free product associated with shallow groundwater); excavation of contaminated sediment in the southern, east and lower east ditch, first impoundment, and onsite ponds; and demolition of onsite structures such as the tipple and abandoned buildings.

Appendix A contains discussions on the rationale for selecting the three separate soil units ("hot spots," vadose soils, and all unconsolidated materials).

- a. Drum, Tank and Debris Removal: It was estimated that as many as 1,600 drums (1,200 intact, 400 non-intact) may be buried on site in four separate areas, generally in the south-central portion of the site. The drum pits range in depth from 6 to 10 ft., and the total volume to be excavated (including drums) is approximately 3,000 cu. yds. The drums would be removed by excavating around the perimeter of the drum storage area, excavating the soil above and around the drums to expose them, and then lifting them from the excavation with a sling or drum grappler. From the excavation, the drums would be transported individually to a staging area where they would be sampled and classified. Leaking drums (estimated to be 25%) would be overpacked immediately after excavation to minimize the volume of leaking material. Drum contents already leaked into the adjacent soils will also be collected and placed into new drums for transport and disposal. After screening and classification, the contents of the drums would be disposed by either onsite or offsite incineration.

There are estimated to be four buried tanks remaining on site with volumes ranging from 1,000 to 7,500 gallons containing decontamination water, gasoline, or kerosene. The fluids in these may be pumped out prior to physical removal of the tanks. The decon water would be treated onsite, while the gasoline and kerosene would be either transported by bulk tanker to an offsite treatment facility or incinerated onsite or offsite. The tanks would be brought to the surface and hauled offsite either intact or in pieces for disposal at a permitted facility. Surface debris would also be collected and transported offsite to an appropriate, permitted disposal facility.



There are risks of exposure to hazardous materials during removal of the buried drums and tanks and a high level of protection would be required for workers involved in these activities. Also, dust and surface water runoff would have to be controlled during operations to minimize potential offsite migration of contaminants. Ambient air monitoring would also be required during the cleanup.

The technologies required to carry out this removal option are readily available; and, as the contaminants will either be destroyed by incineration or treatment, or disposed in secure offsite facilities, the effectiveness of this option is high. The estimated cost to excavate, remove, stage, sample and classify the drums, tanks, and debris is \$1,000,000. Included in this cost is overpacking of leaking drums and sufficient chemical analysis to characterize the materials. This option will be retained for further assembly of alternatives.

- b. Mechanical Excavation of Hot Spot Soils: It is estimated that 27,000 cu. yds. of "hot spot soils" would be mechanically removed. Removal would extend to various depths ranging from 2 ft. to 8 ft., depending on where vadose contamination was detected by soil borings during the RI. Removal would involve staged excavation by various pieces of mechanical equipment and stockpiling the soil in a bermed area with an impermeable base. The stockpile area would be protected from the elements by a newly constructed pole building which would be 50 ft. by 20 ft. in plan, and 20 ft. high. Excavated soil would be treated or disposed and the excavation backfilled with clean fill.

There are risks of exposure to hazardous materials during excavation of the hot spot materials. Also, dust and surface water runoff would have to be controlled to avoid or eliminate offsite contaminant migration.

Ambient air monitoring would also have to be performed during construction. The technology to carry out this option is readily available, and this is a highly effective option for elimination of a large percentage of soil contamination when coupled with either treatment or other disposal

options. Risks of direct contact with contaminated soil in the northern portion of the site and of groundwater contamination from leaching of this area would still exist.

The cost to excavate and stockpile the contaminated soil south of the ponds was estimated as \$270,000. The cost to backfill with treated material is considered later in this chapter. The cost of required support facilities, such as the pole building and impermeable base for soil storage were not included in this section. Those costs are included later in this chapter.

- c. Mechanical Excavation of Vadose Materials: Excavation of all contaminated vadose soil over the entire site by mechanical means would be performed to remove all contaminated materials above the onsite groundwater level. Excavation would be to various depths ranging from 2 ft. to 8 ft., over the site. Based on data collected during the RI, the groundwater level varies from about 5 to 12 ft. below ground surface at the site. Approximately 105,000 cu. yds. of material would be removed. This option could be performed prior to treating or disposing the soil either onsite or offsite. Methods of excavation are the same as those described in Subsection b, and the same hazards exist during excavation.

The technology to carry out this option is readily available and this is a highly effective option for the elimination of contaminated soil when coupled with either treatment or other disposal options. The removal of all soil contamination would eliminate risks of direct contact with soil and the potential for future groundwater contamination from leaching of soil contaminants.

The cost to excavate and stockpile the vadose materials was estimated as \$1,000,000; backfilling with treated soil is considered later in this chapter. This option will be retained for assembly of alternatives.

- d. Mechanical Excavation of All Unconsolidated Materials: Excavation of contaminated unconsolidated materials to bedrock would be considered to remove materials for treatment or other disposal options. The floating free

product associated with the shallow groundwater would also have to be collected. The top of bedrock varies across the site, ranging from about 30 to 40 feet below the surface. As with the vadose soil excavation, this option would also be performed prior to treating or disposing the soil using either onsite or offsite methods.

Approximately 430,000 cu. yds. of contaminated soil was estimated for the total unconsolidated materials removal option. Removal would involve staged excavation by various pieces of mechanical equipment, and stockpiling the soil in a bermed area with an impermeable base. The stockpile area would be protected from the elements by a newly constructed pole building, which would be 50 ft. by 20 ft. in plan, and 20 ft. high. As significant portions of the excavation would be performed below the water table, dewatering of the excavation must be performed (approximately 6,000 gallons/day). For this FS, it was assumed that the collected groundwater could be discharged to an onsite treatment facility. This collected groundwater would include any associated floating free product. The free product would need to be separated and, once collected, drummed and treated along with drummed liquid waste from the drum and tank excavation activities.

There are risks of exposure to hazardous materials during excavation of the soils to bedrock. Also, dust and surface water runoff and runoff would have to be controlled to make management of precipitation more feasible and to prevent or minimize offsite contaminant migration. Ambient air monitoring would also have to be performed during construction.

The technology to carry out this option is readily available and is considered a highly effective option to make these materials available for treatment or other disposal options. The cost to completely excavate the soils to bedrock, stockpile the materials, and dewater the excavation is \$7,900,000. Treatment of collected water is considered in water treatment options. This option will be retained for alternative assembly.

- e. Sediment Excavation: Excavation of sediments in the east, lower east, and south ditches, and in the first impoundment would be performed to limit exposure and access to those contaminated materials, and also to limit contaminant migration. The excavated sediment would require dewatering prior to its final disposition. The volume of sediment is relatively small (less than 1,500 cu. yds.) with an estimated excavation cost of \$27,000. Sediment removal is considered a reliable and effective action to prevent further contaminated sediment migration and to prevent direct contact with contaminated sediment. It will be retained for alternative assembly.
- f. Structure Demolition: A number of onsite buildings, in addition to the tipple and the incinerator, would be demolished and/or dismantled by conventional means and disposed of onsite. Some contaminant residuals may have to be removed from the surfaces of some of the structures prior to demolition to prevent worker exposure. This is considered to be a reliable and effective method of limiting receptor contact with contaminated structures. The estimated cost of structure demolition using conventional methods is estimated to be \$86,000. This option will be retained for alternative assembly.

#### 4.3.5 Treatment

Potentially applicable technologies for the treatment of contaminated soils, sediments and subsurface wastes include the thermal treatment of drummed wastes, vadose materials or all contaminated unconsolidated materials, to include incineration and co-disposal processes. In-situ vitrification of vadose soils is also a potentially applicable technology for the treatment of contaminated soils and sediments.

- a. Thermal Treatment of Drummed and Tank Materials Only (Onsite or Offsite): Drummed and tank waste materials may be treated by thermal destruction techniques using either onsite or offsite facilities. For onsite incineration, a mobile rotary kiln incinerator could be leased to treat the materials with the ash generated either disposed onsite or offsite in a RCRA facility. The disposal of the ash in a RCRA facility would

be necessary unless the ash could be delisted for disposal in a solid waste facility. If the drums and tank materials are transported offsite, the facility utilized would be a permitted incinerator. This option would include the thermal destruction of the contents of up to 1,600 drums.

Incineration is a reliable and effective means of destroying organic contamination; however, inorganic contaminants would remain. Due to the relatively small quantity of material to be incinerated (approximately 66,000 gallons of waste) and the high cost of mobilizing an incinerator to the site (approximately \$1 million), it is more practical to transport the drummed material to an established incinerator for treatment. The cost to excavate, stage, and transport the drums offsite (approximately 1,000 miles) and subsequent treatment and disposal was estimated to be about \$2,300,000, including contingencies. This option will be retained for assembly of alternatives. For alternatives in which soil incineration on site is included, the drums would be incinerated on site at a cost of approximately \$1,100,000. This cost includes neither the cost of disposal of incinerated wastes, nor the initial cost of unit installation.

- b. Co-disposal of Drummed Materials: Combustible liquids contained in the buried drums could be used as fuel in an existing industrial facility. Flammable liquids would be mixed with common fuels and burned to heat a kiln or boiler. Compatibility of combustible liquids may be a potential problem, as the contents of the majority of the drums have not been identified. Bench-scale and pilot testing would be required to ensure complete combustion of the waste material and the burning facility would have to obtain a permit to burn hazardous materials.

Several factors limit the feasibility of co-disposal for drummed waste at this site. First, the amount of material potentially available (approximately 66,000 gallons) is limited. Thus, it may not be economical for an industrial facility to go through the testing and permitting process. Co-disposal is generally used

in the disposal of a consistent ongoing waste stream. Secondly, the contents of the buried drums are presently unknown and probably variable. The quantity and composition of compounds to be disposed must be known to arrange with a potential facility for disposal. These factors cannot be determined until all buried drums are excavated, analyzed, and characterized. Considering these difficulties, co-disposal will be eliminated from further evaluation.

- c. Thermal Treatment of Vadose Materials (Onsite or Offsite): Onsite incineration of contaminated soil in the vadose zone and sediment was evaluated as a means of treatment. Offsite incineration of these materials was also evaluated and will be discussed.

A mobile rotary kiln incinerator could be leased to incinerate materials on the site; non-combustibles and ash (roughly equal to the original excavation volume) could be replaced in the excavation and covered with a multi-layer cap. A rotary kiln is a slowly rotating refractory-lined cylinder mounted at a slight incline to horizontal. The tumbling action about its horizontal axis allows for mixing of the wastes, heat, and air, improving the efficiency of combustion. Rotary kiln systems usually have a secondary combustion chamber or afterburner following the kiln to ensure complete combustion of the waste and gases from the kiln.

As stated previously, incineration would provide a reliable and effective means of destroying organic contamination; however, inorganic contaminants would remain in the ash which may have to be managed as hazardous waste unless delisted. The U.S. EPA requires that licensed RCRA (hazardous waste) incinerators achieve a 99.99 percent destruction and removal efficiency (DRE) for each principal organic hazardous constituent (POHC) designated per 40 CFR 264.342. The present worth cost of incineration was estimated to be \$25,000,000 for all vadose material (105,000 cu. yds.) and \$8,800,000 (27,000 cu. yds.) for "hot spot" incineration only. This cost does not include handling, either before or after treatment. The costs of mobilization and waste screening are included.

The cost of offsite thermal treatment was also evaluated. The cost of transportation (approximately 1,000 miles) and incineration was estimated as \$81,000,000 for 105,000 cu. yds. of material and \$21,000,000 for 27,000 cu. yds. of material. In addition to the high cost, incinerators contacted would be reluctant to accept such a large volume of material and transportation would increase the risk of public contact with hazardous materials.

Onsite thermal treatment will be retained for alternative assembly and offsite thermal treatment will be eliminated.

- d. Thermal Treatment of All Unconsolidated Materials (Onsite or Offsite): The leasing of mobile rotary kiln incinerators was considered for the thermal treatment of all contaminated onsite materials which includes about 430,000 cu. yds. Additionally, the transportation of this same volume of material to an offsite facility for thermal treatment was considered. The reliability of these options is the same as described in previous Item c.

The cost of treating the materials onsite was estimated to be about \$83,000,000 while offsite transportation (approximately 1,000 miles) and treatment was estimated to be about \$330,000,000. Due to the extremely high cost of the offsite option together with the reluctance of offsite incinerators to accept such a large quantity of material, offsite incineration will be eliminated from consideration when assembling alternatives, while onsite thermal treatment will be retained.

- e. In Situ Vittrification of Vadose Soils:

The use of in situ vittrification (ISV) was considered for the treatment of contaminated vadose soil. In the ISV process, electrical energy is passed through the contaminated soil causing the soil to melt via joule heating. Organic contaminants are pyrolyzed during this process and inorganics are immobilized and encapsulated in the resulting vittrified (glass-like) mass. A large fume hood over the treatment area collects off-gas from combustion and pyrolysis of organic materials in the melt,

and this gas is then treated in a mobile, onsite gas treatment system. The use of the ISV process would eliminate the need to excavate the contaminated soil, thus reducing related short-term health risks.

Although this technology is still considered developmental, 46 bench, engineering, and pilot scale tests as well as 5 large scale tests indicate that ISV is a technically viable treatment technology for soils containing chemical contaminants. These tests indicate overall destruction and removal efficiencies (DREs) of approximately 99.99% for organic contaminants and 99.9999% for PCBs specifically. Although tests have not been performed for all hazardous chemicals present at the site, treatment efficiency for organic compounds should be comparable to that provided by incineration. Leach tests (including Extraction Procedure Toxicity and Toxic Characteristics Leach Test) performed on vitrified soil indicate low leach rates for heavy metals of about  $5 \times 10^{-5}$  g/cm<sup>2</sup>/day or lower.

The capital cost associated with the ISV technology, including mobilization and demobilization, is \$4,000,000. The total present worth cost for vitrification of 27,000 cu. yds. of hot spot soil would be \$12,000,000, and the total present worth cost for vitrification of all contaminated vadose soil (105,000 cu. yds.) would be \$27,000,000. These costs are not directly proportional to the volume treated since a significant portion of the cost is related to setting up and moving the system from location to location. The duration of treatment would be two years for the hot spot soils and seven years for all contaminated vadose soil.

In situ vitrification appears to be an effective method of reducing contaminant volume and mobility. It will be retained for alternative assembly.

#### 4.3.6 Disposal

Potentially viable methods for disposal of contaminated solids include the use of offsite RCRA permitted facilities or the construction of a RCRA disposal



facility on site. Treated material may be replaced on site and capped to prevent direct contact and leaching of inorganics.

- a. Onsite RCRA Landfill for Disposal of Vadose Soils: An onsite disposal facility satisfying the regulatory requirements of RCRA could be constructed. For "hot spot" excavation, the facility would be constructed to contain 27,000 cu. yds. of material and for excavation of all vadose contamination, 105,000 cu. yds.

The disposal facility would be constructed with an underlying double liner, as shown in Figure 4-2, and would also be capped as shown in Figure 4-1. The liner proposed is in accordance with EPA/530-SW-85-014, "Minimum Technology Guidance on Double Liner Systems for Landfills and Surface Impoundments, Design, Construction and Operation," April 1987. Facility construction would include stockpiling of solids, dewatering of the excavation, liner construction, contaminated solids placement, and cap construction.

The estimated cost for construction of an onsite RCRA facility is \$2,200,000 for "hot spot" soil and \$8,500,000 for all contaminated vadose soil.

An onsite RCRA landfill appears to be an effective method of contaminated solids disposal as it contains contaminants, prevents direct contact, and eliminates or minimizes leaching of contaminants to groundwater. It will be retained for the assembly of alternatives.

Groundwater and leachate monitoring will be required to permit performance evaluation of the landfill. The cost for these items will be considered separately under groundwater control.

- b. Onsite RCRA Landfill for Disposal of All Unconsolidated Materials: If all contaminated solids were removed to the top of rock, the disposal volume would be about 430,000 cu. yds.

Construction of this facility would be similar to the one previously described for the vadose soils, with two differences. It would have to be mounded, and would be 20 to 25 ft. higher than the existing grade. Construction would also require

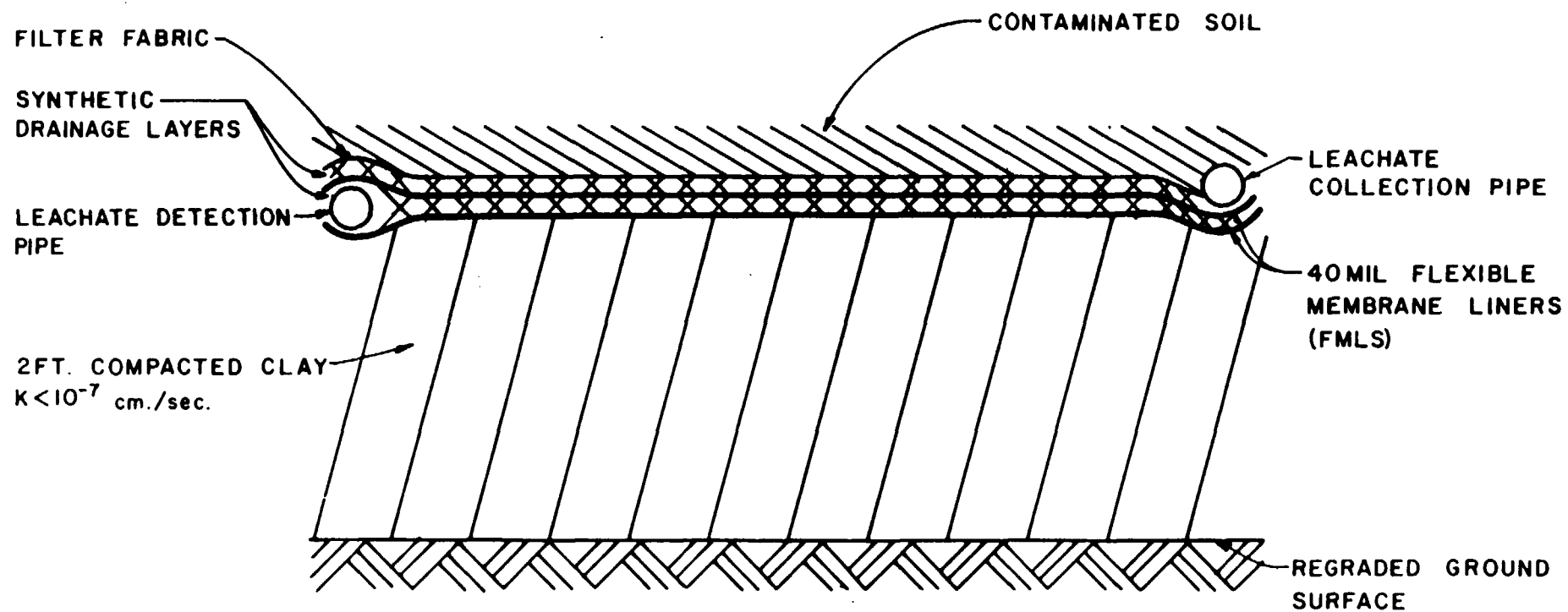


FIGURE 4 - 2  
TYPICAL RCRA LANDFILL  
LINER  
SUMMIT NATIONAL FS

backfilling the excavation with clean fill to a depth of about 8 ft. below existing grade (approximate current piezometric surface).

The estimated cost of onsite disposal of all contaminated solids, using an onsite RCRA facility is \$30,000,000.

An onsite RCRA landfill appears to be an effective method to dispose of the large volume of contaminated solids from the excavation to bedrock, as it ensures containment of contaminants, prevention of direct contact, and elimination or minimizing of leaching to groundwater. It will be retained for the assembly of alternatives.

- c. Onsite Soil Replacement: Soil which is excavated and treated onsite may be replaced into the excavation after construction of a RCRA liner (see Sections 4.3.6.a. and b.), and subsequently covered with a multi-layer cap. A multi-layer cap would prevent erosion, direct contact, or leaching to groundwater of any remaining contaminants. The costs for backfilling and compacting the various soil volumes are considered inherent to treatment, which is where such costs may be found. Costs for RCRA landfills for the various soil volumes may be found in the immediately preceding sections.
- d. Offsite Disposal of Vadose Soils: Excavated vadose soil, sediment, and subsurface waste would be transported to and disposed of at an existing offsite RCRA-permitted landfill. The two nearest RCRA-permitted landfills are each about 250 miles from the site. This distance is used for cost estimating purposes. Offsite disposal at a RCRA landfill is considered an effective and reliable means of containing contaminated soil, sediment, or subsurface waste, although contaminants are not destroyed.

A cost of \$120 per cu. yd. was estimated for disposal costs. Including transportation (excavation costs were presented earlier), the estimated cost of offsite disposal for "hot spot" soils is \$6,400,000, and the cost for all contaminated vadose soils is \$26,000,000. This cost is significantly greater than the cost of onsite containment remedial actions, including

onsite disposal in a RCRA landfill. Because of this high cost, offsite disposal of contaminated vadose soils at a RCRA landfill will not be retained for alternative assembly.

- e. Offsite Disposal of Unconsolidated Materials: If all contaminated soil to the top of rock were removed for disposal, the material volume would be 430,000 cu. yds. Including only transportation and disposal costs, (excavation costs were presented earlier), the estimated cost of offsite disposal of contaminated solids excavated to bedrock is \$110,000,000. This cost significantly exceeds the cost of onsite containment remedial actions, including onsite RCRA landfill. Because of this excessive cost, offsite disposal at a RCRA landfill of contaminated solids obtained from an excavation to bedrock will not be retained for alternative assembly.

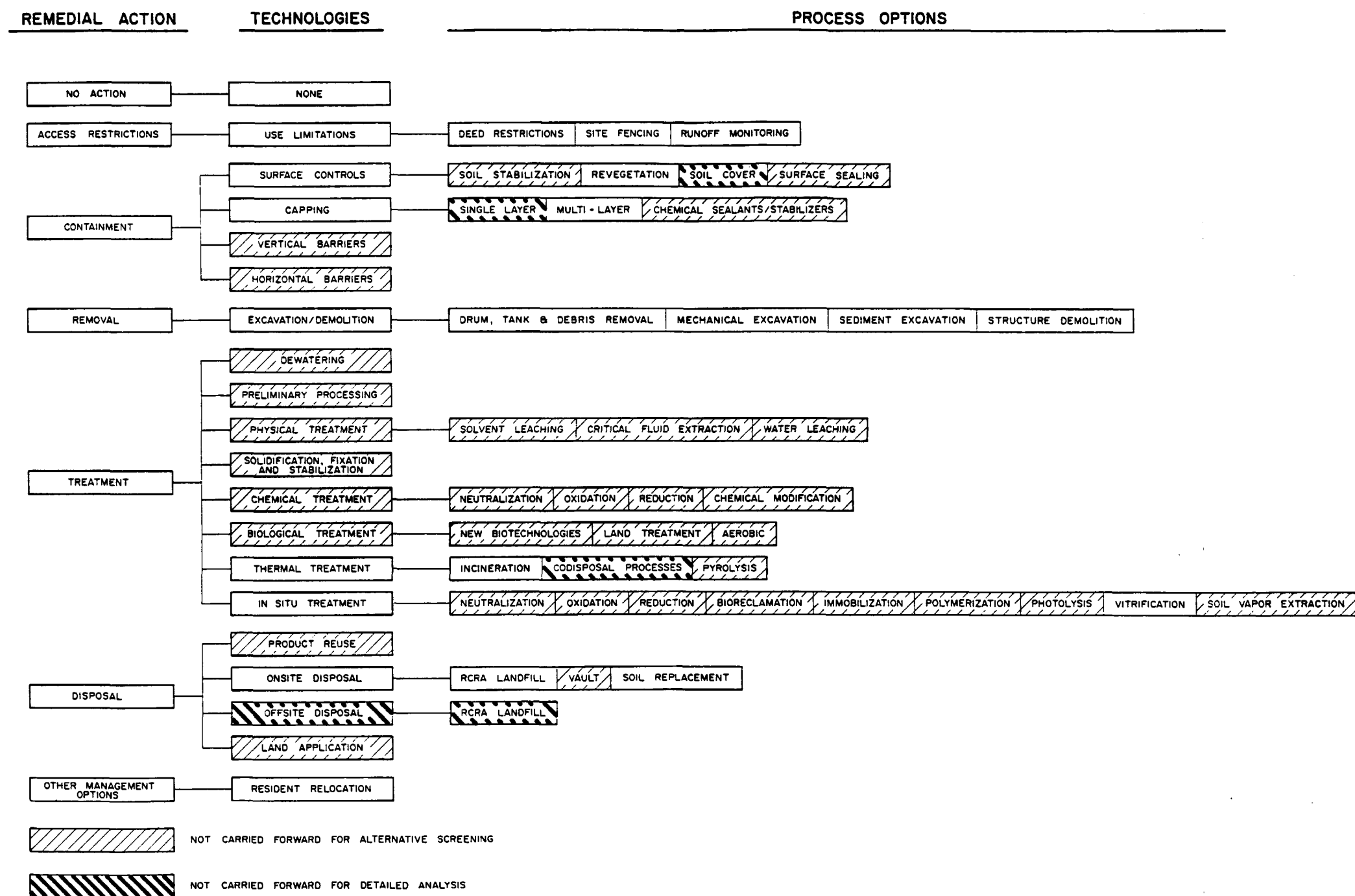
#### 4.3.7 Other Management Options

- a. Resident Relocation: Relocation of nearby residents was considered a viable option to reduce receptor contact with contaminated solids. The Watson residence is located about 50 ft. beyond the existing eastern site fence. The soil in this area is contaminated with PCB's and health risks are projected for residents in this area under current conditions. Resident relocation would effectively and reliably limit contact with contaminated soil, but would not reduce the toxicity, mobility, or volume of any of the contamination. The residence could be physically moved to an uncontaminated area of the Watson property about 200 ft. east of its current location, and a new water well provided at a cost of approximately \$38,000. The exact terms of the relocation will be discussed with the affected parties before a decision is made. This option will be carried forward into the alternative assembly process.

The technology screening for the soil/sediment/subsurface waste operable unit is summarized on Figure 4-3 and Table 4-2.

#### 4.4 SURFACE WATER OPERABLE UNIT

General response actions and applicable technologies for surface water were outlined in Table 3-7, and



REFER TO TABLES 3-6 AND 4-2 FOR SCREENING DISCUSSIONS

FIGURE 4 - 3  
SOIL SEDIMENT/  
SUBSURFACE WASTE TECHNOLOGIES  
SUMMIT NATIONAL FS

TABLE 4-2  
SUMMARY OF APPLICABLE TECHNOLOGY SCREENING  
SOIL/SEDIMENT/SUBSURFACE WASTE OPERABLE UNIT  
SUMMIT NATIONAL FEASIBILITY STUDY

General Response Action	Remedial Technology	Process Option	Effectiveness	Implementability	Cost	Retained	Rejection Rationale
NO ACTION	None		Risks are identified in the Environmental and Public Health Risk Assessment	--	None	Yes	
ACCESS RESTRICTIONS	Use Limitations	Deed Restrictions	Reduces risk of direct contact with contaminated soil, sediment, and subsurface wastes. Contaminants remain on site. Effectiveness is dependent upon implementation in the future. Does not provide a physical barrier to site access.	Easily implemented. Enforcement may be difficult.	Low capital cost. No maintenance cost.	Yes	
		Site Fencing	Reduces risks of direct contact with contaminated soil, sediment and subsurface waste. Provides a physical barrier to site access. Effectiveness is dependent on implementation in future.	Easily implemented. Routinely used.	Approximately \$72,000 capital cost. Includes purchase of 4 acres. Low maintenance cost.	Yes	
	Monitoring	Runoff Monitoring	Used to evaluate performance of other surface water remedial actions and detect migration of contaminants. Does not remove mobility, toxicity, or volume of contaminants.	Commonly used sampling and analysis procedures.	Moderate operation cost. Present worth of \$150,000.	Yes	
CONTAINMENT	Surface Controls	Revegetation	Stabilizes surface soil, reduces erosion and thereby reduces mobility. Toxicity and volume of contaminants is unaffected.	Common procedure. Easy to implement.	Present worth of \$46,000. Little or no maintenance required.	Yes	
		Soil Cover	Reduces mobility of contaminants via erosion and potential for receptor contact. Does not prevent leaching of soil contaminants to groundwater.	Technology is proven and available.	Capital cost of \$720,000. Frequent replacement	No	Does not reduce leaching of soil contamination to groundwater.

Table 4-2  
Page 2 of 6

General Response Action	Remedial Technology	Process Option	Effectiveness	Implementability	Cost	Retained	Rejection Rationale
CONTAINMENT (cont'd)	Capping	Single Layer Cap	Reduces mobility of contaminants and risk of direct contact; however, contaminants remain on site. Restrictions on future use required. Some materials incompatible with onsite wastes. Does not satisfy RCRA.	Construction is relatively simple. Potential for cracking due to freeze-thaw cycles.	Low capital cost relative to other capping alternatives - \$1,200,000. High maintenance due to frequent cracking.	No	Does not reduce leaching of soil contaminants to groundwater.
		Multi-Layer Cap	Reduces mobility of contaminants and risk of direct contact; however, contaminants remain on site. Restrictions on future use required. Meets RCRA requirements.	Construction is relatively complex and time consuming. Least susceptible to cracking. Self-healing if cracked.	Present worth of \$3,700,000.	Yes	
REMOVAL	Drum, Tank and Debris Removal		Eliminates drummed waste and tanks as source for contaminant migration. Waste removal requires treatment and/or disposal. Drum and tank removal increases risk of drum or tank rupture and further contamination of soil.	Technically feasible as drums and tanks are located near the surface.	Capital cost of \$900,000.	Yes	
	Partial Soil Excavation (Hot Spots)		Excavation of most contaminated soil on site which is located south of the existing ponds (27,000 cu. yds.). Eliminates the majority of soil contaminants as a source of contaminant migration. Short-term impacts due to creation of noise, odors, and dust during excavation. Soil removed requires treatment and/or disposal.	Technically feasible. Can be performed using common construction equipment.	Capital cost of \$270,000.	Yes	
	Partial Soil Excavation (Vadose Zone)		Excavation of 105,000 cu. yds. Eliminates or greatly reduces soil contaminants as a source for contaminant migration. Short-term impacts due to creation of noise, odors, and dust during excavation. Soil removed requires treatment and/or disposal.	Technically feasible. Can be done using common construction equipment.	Capital cost of \$1,000,000.	Yes	

Table 4-2  
Page 3 of 6

General Response Action	Remedial Technology	Process Option	Effectiveness	Implementability	Cost	Retained	Rejection Rationale
REMOVAL (cont'd)	Complete Soil Excavation (to Bedrock)		Excavation of 430,000 cu. yds. Eliminates or greatly reduces soil contaminants as a source for contaminant migration. Short-term impacts due to creation of noise, odors, and dust during excavation. Soil removed requires treatment and/or disposal.	Technically feasible; however, removal of all contaminated soil will be difficult due to large volume and will require a large amount of time.	Capital cost of \$7,900,000.	Yes	
	Sediment Excavation	Dredging	Greatly reduces sediment contaminants as a source of contaminant migration. Sediment removed requires treatment and/or disposal.	Technically feasible for small volume of sediment present on site, estimated to be 1500 cu.yds.	Capital cost of \$27,000. Small volume of contaminated sediments.	Yes	
	Demolition	Demolition of Onsite Structures	Eliminates onsite structures as a potential source of contaminants. Requires treatment and/or disposal of demolition materials.	Technically feasible using common construction equipment	Capital cost of \$86,000.	Yes	
TREATMENT	Thermal	Rotary Kiln Incineration (Drummed and Tank Materials)	Eliminates onsite sources of concentrated contaminants.	Incinerate onsite if units are on site for soil treatment. Incinerate off site if only drummed materials to be treated. Both units are available.	High capital and operation and maintenance costs. Present worth of \$2,300,000 for off site, including excavation, staging, transport, and treatment. Present worth of \$1,100,000 for onsite incineration when used in conjunction with onsite soil incineration.	Yes (Offsite)	



Table 4-2  
Page 4 of 6

General Response Action	Remedial Technology	Process Option	Effectiveness	Implementability	Cost	Retained	Rejection Rationale
TREATMENT (Cont)	Thermal	Rotary Kiln Incineration (Hot Spots)	Requires incineration of 27,000 cu. yds. of contaminated solids. Eliminates majority of soil contamination.	Mobile and transportable units are available for onsite incineration. Onsite incineration requires permitting. Ash from onsite incineration must be delisted or placed in RCRA vault.	High capital and operation and maintenance costs. Present worth of \$8,800,000 for onsite, \$21,000,000 for offsite.	Yes (Onsite)	
		Rotary Kiln Incineration (Vadose Soils)	Requires incineration of 105,000 cu. yds. of contaminated solids. Requires several years before incineration of contaminated soil is complete during which risks are not fully mitigated.	Mobile and transportable units are available for onsite incineration. Onsite incineration requires permitting. Ash from onsite incineration must be delisted or placed in RCRA vault.	High capital and operation and maintenance costs. Present worth of \$25,000,000 for onsite, \$81,000,000 for offsite.	Yes (Onsite)	
		Rotary Kiln Incineration (Unconsolidated Materials)	Requires incineration of 430,000 cu. yds. of contaminated solids. Requires several years before incineration of contaminated soil is complete during which risks are not fully mitigated.	Mobile and transportable units are available for onsite incineration. Onsite incineration requires permitting. Ash from onsite incineration must be delisted or placed in RCRA vault.	High capital and operation and maintenance costs. Present worth of \$83,000,000 for onsite, \$330,000,000 for offsite.	No	Significantly increased costs not justified by added benefits.
		Co-Disposal	Eliminates onsite sources of concentrated contaminants. Only applicable for combustible liquid or semi-liquid wastes.	Cannot locate potential co-disposal facility until all drums are excavated and classified. Variable contents of drums would make implementation of this option extremely difficult.	--	No	Implementation is extremely difficult due to unknown and variable contents of drums.
		Vitrification	Destroys organic contaminants and binds up all other contaminants in glass-like mass.	Mobile and transportable units are available for use. Would require treatment of off-gas. Onsite generation of electricity probably needed. Soil cover required at completion.	High capital and operation and maintenance costs. Present worths of \$12,000,000 for hot spot soils, and \$27,000,000 for vadose soils.	Yes	

Table 4-2  
Page 5 of 6

General Response Action	Remedial Technology	Process Option	Effectiveness	Implementability	Cost	Retained	Rejection Rationale
DISPOSAL	Onsite Disposal	RCRA Landfill (Vadose Soils)	Greatly reduces mobility of waste. Toxicity and volume are unaffected. Reliable and protective if properly constructed. Vault must store 105,000 cu. yds.	Limited space and other conditions make proper construction and operation of onsite RCRA landfill difficult.	Moderate capital cost. High to very high operation and maintenance cost. Estimated present worth of \$8,500,000.	Yes	
		RCRA Landfill (Unconsolidated Soils)	Greatly reduces mobility of waste. Toxicity and volume are unaffected. Reliable and protective if properly constructed. Vault must store 430,000 cu. yds.	Limited space and other conditions make proper construction and operation of onsite RCRA landfill difficult.	Moderate capital cost. High to very high operation and maintenance cost. Estimated present worth of \$30,000,000.	Yes	
		Soil Replacement (Treated Soil)	Replacement in lined landfill and capping of treated soil reduces the amount of contamination on site and cap prevents contact or migration of any remaining contaminants.	Cap and liner construction relies on well demonstrated technologies, as does backfilling and compaction.		Yes	
	Offsite Disposal	RCRA Landfill (Hot Spot Soils)	Greatly reduces mobility of waste. Toxicity and volume are unaffected. Reliable and protective if properly constructed. Offsite disposal of 27,000 cu. yds.	Offsite landfill would require trucking of a large quantity of contaminated material which may not be administratively feasible. Offsite landfill capacity is limited.	Estimated present worth of \$6,400,000	No	Significantly greater cost than onsite RCRA facility, with little added benefit.
		RCRA Landfill (Vadose Soils)	Greatly reduces mobility of waste. Toxicity and volume are unaffected. Reliable and protective if properly constructed. Offsite disposal of 105,000 cu. yds.	Offsite landfill would require trucking of a large quantity of contaminated material which may not be administratively feasible. Offsite landfill capacity is limited.	Estimated present worth of \$26,000,000.	No	Significantly greater cost than onsite RCRA facility, with little added benefit.

Table 4-2  
Page 6 of 6

General Response Action	Remedial Technology	Process Option	Effectiveness	Implementability	Cost	Retained	Rejection Rationale
	Offsite Disposal (cont)	RCRA Landfill (Uncon- solidated Soils)	Greatly reduces mobility of waste. Toxicity and volume are unaffected. Reliable and protective if properly constructed. Offsite disposal of 430,000 cu. yds.	Offsite landfill would require trucking of a large quantity of con- taminated material which may not be administra- tively feasible. Offsite landfill capacity is limited.	Estimated present worth of \$110,000,000.	No	Signifi- cantly greater cost than onsite RCRA facility, with little added benefit.
OTHER OPTIONS	Resident Relocation (Watson)	--	Removes potential receptors from areas of contamination. Does not affect mobility, toxicity, or volume of contaminants.	May be difficult to implement from an admin- istrative standpoint.	Capital cost of \$38,000	Yes	

presented on Figure 3-2. The surface water operable unit includes approximately 500,000 gallons of water contained in the onsite ponds and an average runoff of 11,000 gallons/day. This average runoff value was calculated on the basis of annual precipitation and runoff.

#### 4.4.1 No Action

The NCP requires No Action to be carried through detailed analysis of alternatives.

#### 4.4.2 Access Restrictions

As with the soil, sediment, and subsurface waste operable unit, the purpose of access restrictions is to reduce or prevent the exposure of receptors to contaminants. For the surface water operable unit, site fencing would prevent future contact with contaminated water on site, and runoff monitoring would be used to determine if contaminated surface water is leaving the site. Fencing was discussed previously under the soil/sediment/subsurface waste operable unit. Runoff monitoring would involve the collection and analysis of surface water leaving the site. As previously discussed, the present worth cost of runoff monitoring is \$150,000. Both options are considered technically viable and could be used in conjunction with other remedial technologies as part of a comprehensive remedial action at the site.

#### 4.4.3 Containment

Containment technologies applicable to surface water include capping and surface controls. Capping and the revegetation and soil cover surface control options were discussed previously under the soil, sediment, and subsurface waste operable unit in Section 4.3.3. Applicable surface controls for this operable unit which were not discussed previously include grading and diversion and collection systems.

The entire site would be graded to eliminate surface water ponding and provide positive drainage off site. Surface water collection and diversion options at the site would consist of constructing dikes and berms to reduce the volume of runoff and prevent runoff, and the relocation of the south ditch about 100 feet south of its present location which would allow offsite drainage to bypass site-related contaminated areas.

Contaminated water on site would be treated prior to offsite discharge. The relocation of the ditch would require the acquisition of about two acres of property from the existing cement plant property.

This combination of actions would effectively and reliably reduce or eliminate the discharge of contaminated surface water from the site, as well as limit the volume of contaminated water requiring treatment. Regular maintenance would be required for the dikes and berms to prevent leaking and erosion. The estimated present worth of this combination of options is \$640,000 (\$430,000 for grading and \$210,000 for the diversion and collection system). This cost does not include the cost of acquiring two acres of land south of the site to allow relocation of the south ditch. These technologies will be retained for alternative assembly.

#### 4.4.4 Collection

Surface water currently impounded in the east and west ponds could be removed from the ponds by various mechanical methods such as pumping, bailing, gravity siphons, etc. The available technologies are effective methods of removing the surface water prior to treatment or disposal. They may be incorporated with little potential for contaminant contact or release. Considering the volume of water present in the ponds (approximately 500,000 gallons), the cost for removal is expected to be about \$20,000.

#### 4.4.5 Treatment

Viable technologies carried over from Chapter 3 include physical treatment, chemical treatment and biological treatment. The costs estimated for the various treatment options that follow include the costs to treat both the surface water and groundwater. Costs are based on a 50 GPM treatment which is sufficient to handle groundwater treatment as well as surface runoff. Treatment of surface water from the existing ponds should require less than six months.

##### a. Physical Treatment

Granular Activated Carbon (GAC): GAC is a feasible technology for the treatment of surface water contaminated with either volatile or base neutral organics. GAC can reduce most of the

organic compounds present to levels as low as 1 ug/l, and removal of base neutral PAH's have been documented to the ng/l level. Inorganic compounds and low molecular weight, polar organic compounds are not effectively removed by the system. Pretreatment of inorganics, particularly iron and manganese, would be required for use with GAC to avoid blinding the adsorbent. Spent adsorbent would either be thermally regenerated or incinerated. For the observed contaminant concentrations, GAC appears to be a feasible treatment technology for the surface water. The present worth cost of GAC treatment was estimated to be about \$464,000. GAC will be carried forward for inclusion in a comprehensive treatment system.

Air Stripping: This option would involve the use of counter current packed towers to remove volatile organic compounds (VOCs) from the waste water. The VOCs would be transferred to air bubbles passed through the contaminated water. The air emissions from the stripping tower would have to be collected and treated prior to discharge to the atmosphere. It is a fully demonstrated process whose use is common. Air stripping units are commercially available. Although not a stand-alone alternative for the contamination present on site, it may be combined with coagulation/flocculation, sedimentation, and filtration as a complete treatment system. The present worth cost of adding the air stripping unit, including GAC treatment of the emissions, is estimated to be about \$1,210,000. Due to its significantly greater cost than GAC, along with no added benefit, air stripping will not be retained for inclusion in the surface water treatment system.

Steam Stripping: This option is similar to air stripping, except for the use of steam, rather than air, to remove the VOCs. The additional heat from the steam allows more effective volatile removal than air stripping. However, steam stripping requires more complex apparatus and is more costly to operate than air stripping. Since air or steam stripping would be used to reduce

volatile organic content in lieu of carbon adsorption, the added effectiveness of steam stripping is probably not justified. The present worth cost of adding a steam stripping unit is estimated to be about \$1,318,000. Steam stripping will not be carried forward.

Coagulation/Flocculation/Sedimentation:

Coagulation/flocculation/sedimentation consists of the addition of chemical coagulants (i.e., alum, ferric and ferrous chloride and sulfate, polymers, and lime), usually upstream of filtration units, to increase the efficiency of solids separation. Laboratory testing and possibly pilot testing will be necessary to determine which coagulants will be most effective.

Coagulation/flocculation/sedimentation is a well-developed process used extensively to treat waters containing suspended and colloidal solids. It can be used as a portion of a complete water treatment facility. Sedimentation tanks will also serve a dual function providing storage for storm water, thus allowing steady state water treatment regardless of natural runoff fluctuations. The estimated present worth cost of coagulation/flocculation including holding tank construction is \$550,000. It will be retained for inclusion in the final water treatment system analyzed.

Flotation: Flotation could be used to remove suspended material from contaminated water. A gas (probably air) would be "bubbled" through contaminated water in a reactor causing hydrophobic particles to accumulate at the gas/water interfaces of the bubbles. By this means, particles would be transported to the water surface as a froth which could be skimmed off. Surfactants could be added to increase efficiency.

Although this technology is well documented and would provide an effective means of removing particulate matter from contaminated water, it does not provide the advantage of storage potential as does sedimentation. It may also result in the emission of VOC's which would require collection and further treatment. Both of these technologies perform the same function, but the added benefits of sedimentation make it the preferable option. Flotation will not be retained for assembly of alternatives.

Granular Media Filtration: Filtration can be used for surface water treatment to remove suspended solids. It is expected that this technology will be used in conjunction with coagulation/flocculation and sedimentation for metals removal. The estimated cost to install and operate this option is included in the \$550,000 cost of coagulation/sedimentation/flocculation. Filtration will be carried forward for inclusion in the final water treatment system analyzed.

- b. Chemical Treatment: Precipitation is the only chemical treatment that survived the initial screening performed in Chapter 3. Precipitation is a physical and chemical technique that can be used to remove metals from an aqueous stream. This treatment would be necessary prior to activated carbon treatment or stripping to minimize fouling. Frequently, the pH of the waste stream is adjusted before precipitation to optimize precipitation conditions. Many metals were detected in the surface water samples and can be reduced by precipitation treatment. Both hydroxide and sulfide precipitation can be used.

Hydroxide precipitation is accomplished by adding lime to the waste water. Heavy metal hydroxides are precipitated out of solution, along with calcium, magnesium, iron, and manganese. Other inorganic and organic contaminants can then be adsorbed onto the metal hydroxide particles and removed, although significant organics removal is not expected. Precipitate sludges would be disposed in the same manner as contaminated soils for a given alternative.

Sulfide precipitation also removes heavy metals, but iron and manganese are not removed as effectively as in hydroxide precipitation and excess sulfide could produce hydrogen sulfide gas. Hydrogen sulfide gas has an extremely unpleasant odor which could be disturbing to nearby residents, and is toxic and potentially fatal if inhaled at concentrations as low as 10 ppm. A sulfide treatment system requires careful pH control and an H<sub>2</sub>S monitoring and alarm system for worker protection to avoid occupational exposure. Due to these potential problems, the sulfide precipitation system will not be retained. The hydroxide precipitation system will



be retained for inclusion in the treatment system. The estimated cost of this system is included in the cost of coagulation/flocculation/sedimentation, the present worth cost of which was \$550,000.

- c. Biological Treatment: Biological treatment technologies remaining from Chapter 3 include aerobic and anaerobic treatment methods and the use of new biotechnologies.

Aerobic Treatment: Aerobic treatment options passing the initial screening in Chapter 3 included activated sludge, trickling filters, and rotating biological contactors. These methods basically result in the oxidation of most organic materials contained within the contaminated surface water by the use of a mixed culture of organisms. These methods would be used in lieu of an air stripper or GAC treatment in a complete treatment unit, as none of them are stand-alone treatment methods.

The estimated present worth costs for treatment using these units are as follows:

Activated Sludge	\$4,500,000
Trickling Filters	\$1,200,000
Rotating Biological Contactors	\$7,100,000

Although each of these methods can be effective and reliable in treating organically contaminated water, each has at least one major drawback which air stripping and GAC do not:

- Low strength contaminated surface water would require Biochemical Oxygen Demand (BOD) augmentation.
- The activated sludge process results in the generation of non-reusable sludge which must be treated as a hazardous waste.
- Trickling filters generally have relatively high land area requirements.
- Rotating biological contactors are more suited for secondary treatment. Additionally, excess biomass must be treated as a hazardous waste.

Due to the above technical reasons and the higher costs of these options compared to physical treatment methods, aerobic treatment methods will not be retained for further evaluation.

Anaerobic Treatment: Anaerobic treatment options passing the initial screening in Chapter 3 included anaerobic digestors, anaerobic contact process, and anaerobic filters. These methods accomplish elimination of organic contaminants by using acid-forming bacteria to change the organics to organic acids, then gasifying the organic acids into methane and carbon dioxide. As with the aerobic processes, the anaerobic processes would be used in lieu of an air stripper or GAC treatment in a total treatment system.

Although these methods are effective, reliable, and have been in use for many years, each has drawbacks not found in air strippers and GAC:

- Augmentation of BOD influent load would be required for low level waste.
- Anaerobic digestors and anaerobic contact processes are primarily suited for use in reduction of biological sludges.
- Anaerobic processes have capital costs greater than most other reactor configurations.

Due to the technical problems and the higher costs than physical treatment methods, anaerobic treatment methods will not be retained for alternative assembly.

New Biotechnologies: New biotechnologies involve the use of cultured or genetically altered microbes to remove organic contaminants. As with other biological treatment methods, pretreatment for the removal of metals and other solids would be required.

Although not proven on a full-scale basis, this method shows promise in the range of contaminants it can degrade, along with the level of removal it can provide. These units are commercially available, and appear to be technically feasible.

The estimated cost for this process is approximately \$520,000 (capital) plus an O & M cost of \$0.01/gallon treated, which results in a present worth cost of \$3,000,000. Considering the significant increase in costs over the physical treatment methods, such as carbon adsorption, additional benefits in terms of increased effectiveness do not occur. This method will not be retained for alternative assembly.

- d. Surface Water Treatment Summary: Physical and chemical treatment technologies remaining after screening include coagulation/flocculation, granular activated carbon, precipitation, sedimentation, and granular media filtration. These technologies can be assembled into one treatment system to effectively remove the potential metals, PAH's, and organic surface water contaminants.

At the first point in the treatment system, lime is added to the surface water to precipitate the metals. A coagulant such as alum or a polymer can also be added to enhance solids settling. Flocculation and clarification (sedimentation) will follow and can be accomplished in one basin. Sludge is removed from the bottom of the basin and can be thickened and disposed of in a RCRA landfill. A portion of the waste sludge can be recirculated to the basin influent to enhance precipitation and settling. A sand or multimedia filter will then remove most of the remaining suspended solids. Effluent from the filter can be used for filter backwashing, and the filter backwash wastewater can be added to the clarifier.

The final treatment process is activated carbon adsorption. Water is passed through a fixed bed of activated carbon for organic contaminant removal. Either a pressure or gravity carbon contacting system could be used. The carbon will require periodic replacement or regeneration. It was assumed that spent carbon can be disposed of as a hazardous waste, or incinerated. Construction of carbon regeneration facilities would not be cost-effective for the small amount of carbon to be used; however, if it is acceptable, regeneration of carbon can be provided by the manufacturer and regenerated carbon used in place of virgin carbon.

The present worth cost of a 50 gpm treatment plant for the site is about \$1,132,000. This combined treatment option will be retained for alternative assembly.

#### 4.4.6 Waste Water Discharge

Surface water discharge options passing the initial screening in Chapter 3 included discharge to a POTW, discharge to a RCRA facility for treatment, discharge to surface water, and deep well injection.

- a. Discharge to POTW: Publicly owned treatment plants (POTW) as far away as Youngstown, Ohio were contacted relative to accepting contaminated surface water for treatment. POTWs contacted included: Akron, Summit County, Alliance, Youngstown, Canton, Massillon, and the Northeast Ohio Regional Sewer District. All of the plants contacted indicated they were not permitted to accept wastewater from a Superfund site or from outside their district. Therefore, this option will not be retained for inclusion in alternative assembly.
- b. Discharge to Deep Injection Wells: Contaminated water could be disposed in deep injection wells. The quantity of water to be disposed (approximately 40,000 gallons/day) is large, and well operators are reluctant to accept such a volume. Assuming that an operating, permitted deep injection well could be found within 250 miles of the site, the estimated present worth cost for transportation alone is \$5,000,000. Additional costs would be incurred for actual injection of the water. Based on the high cost and administrative difficulties in comparison to onsite physical treatment, deep well injection will be eliminated from alternative assembly.
- c. Discharge to Surface Water: After onsite treatment, the treated effluent must be disposed. The treatment system discharge will meet appropriate NPDES standards.

Due to potential enforcement actions under consideration by the Ohio EPA against nearby solid waste facilities, direct discharge to nearby surface water course will not be permitted. A 6-inch diameter steel pipe will be constructed

from the onsite treatment unit discharge to a point approximately 3,000 ft. southeast, where it will be outletted into natural drainage. Present worth cost of this discharge pipe is approximately \$112,000. This option will be retained for inclusion in remedial alternative assembly.

- d. Discharge to RCRA Facility: Two RCRA facilities were contacted relative to receiving contaminated water for treatment. For estimating purposes, a treatment cost of \$0.15/gallon was used, along with transportation costs based on a 50 mile trip (one way). Based on these figures, the present worth of this option is about \$26,000,000. Discharge to a RCRA facility for treatment is an effective and reliable method of discharging contaminated surface water, however, an onsite treatment facility could perform the same function at significantly less cost. Discharge to a RCRA facility will not be retained for alternative assembly.

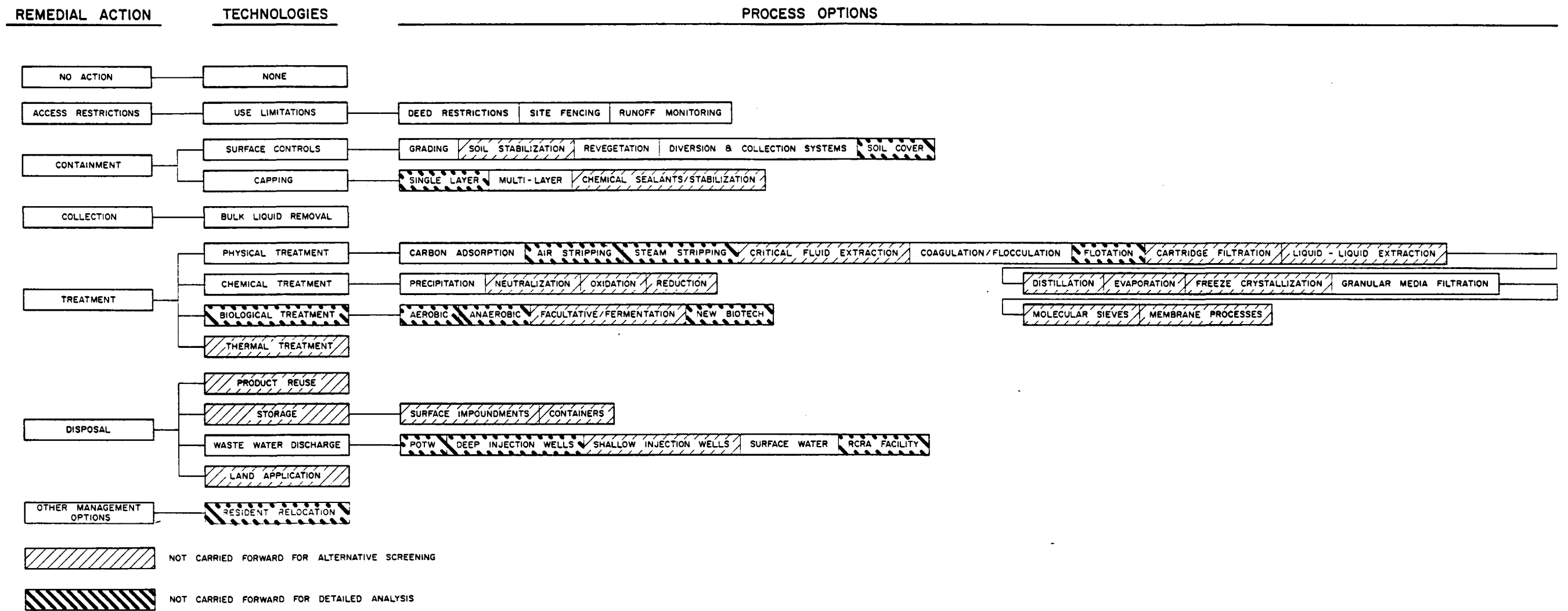
#### 4.4.7 Other Management Options

The only technology that survived the Chapter 3 screening in this action category was resident relocation. Relocation of nearby residents was considered a viable option to reduce receptor contact with contaminated surface water. The Watson residence, east of the site, is located in an area which periodically received surface water overflow from the east pond. During the spring of 1987 the berm of the east pond was built up and a controlled pond overflow system was installed by TAT through an emergency response action. This has effectively eliminated the surface water discharge in the Watson property. For this reason, the relocation of the Watson residence will not be included for assembly in remedial alternatives as a surface water management option.

The technology screening for the surface water operable unit is summarized on Figure 4-4 and Table 4-3.

#### 4.5 GROUNDWATER OPERABLE UNIT

Groundwater remedial technologies and process options are considered together. General response actions and applicable technologies for groundwater and free floating product are presented on Figure 3-5, and discussed in Table 3-8.



REFER TO TABLES 3-7 AND 4-3 FOR SCREENING DISCUSSIONS

FIGURE 4 - 4  
SURFACE WATER TECHNOLOGIES  
SUMMIT NATIONAL FS

TABLE 4-3  
SUMMARY OF APPLICABLE TECHNOLOGY SCREENING  
SURFACE WATER OPERABLE UNIT  
SUMMIT NATIONAL FEASIBILITY STUDY

General Response Action	Remedial Technology	Process Option	Effectiveness	Implementability	Cost	Retained	Rejection Rationale
NO ACTION	None		Risks are identified in the Environment and Public Health Risk Assessment	--	None	Yes	
ACCESS RESTRICTIONS	Use Limitations	Deed Restrictions	Reduces risk of direct contact with contaminated soil, sediment, and subsurface wastes. Contaminants remain on site. Effectiveness is dependent upon implementation in the future. Does not provide a physical barrier to site access.	Easily implemented. Enforcement may be difficult.	Low capital cost. No maintenance cost.	Yes	
		Site Fencing	Reduces risks of direct contact with contaminated surface water on site. Does not reduce risks associated with surface water leaving the site. Effectiveness is dependent upon implementation in the future	Easily implemented. Routinely used.	Approximately \$72,000 capital cost. Includes purchase of 4 acres. Low maintenance cost.	Yes	
	Monitoring	Runoff Monitoring	Used to evaluate performance of other surface water remedial actions, and detect migration of contaminants. Does not reduce mobility, toxicity, or volume of contaminants.	Commonly used sampling and analysis procedures.	Moderate operation cost. Present worth of \$150,000.	Yes	
CONTAINMENT	Surface Controls	Grading	Reduces run-on and run-off, thus reducing volume of contaminated surface water. Existing contaminated surface water will still require treatment/disposal. Short-term impacts due to creation of noise, odors and dust.	Common procedure for civil construction projects. Easy to implement.	Capital cost of \$430,000.	Yes	
		Revegetation	Stabilizes surface soil, thus reducing surface water contamination. Does not reduce risks associated with surface water leaving site.	Common procedure. Easy to implement.	Present worth of \$46,000 Little or no maintenance.	Yes	
		Diversion and Collection	Reduces run-on and run-off, thus reducing volume of contaminated surface water generated. Contaminated surface water is contained for subsequent treatment/disposal.	Common procedure for civil construction projects. Easy to implement.	Capital cost of \$210,000 Low maintenance costs.	Yes	

Table 4-3  
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General Response Action	Remedial Technology	Process Option	Effectiveness	Implementability	Cost	Retained	Rejection Rationale
CONTAINMENT (Cont'd)		Soil Cover	Reduces surface water contamination due to contact with contaminated soil.	Common procedure, relatively simple to implement.	Capital Cost of \$720,000. Period maintenance required.	No	Does not provide adequate protection against infiltration.
	Capping	Single Layer Cap	Reduces surface water contamination due to contact with contaminated soil.	Construction is relatively simple. Potential for cracking due to freeze-thaw cycles.	Low capital cost relative to other capping alternatives - \$1,200,000. High maintenance due to cracking.	No	Does not provide adequate protection against infiltration.
		Multi-Layer Cap	Reduces surface water contamination.	Construction is relatively complex and time consuming. Least susceptible to cracking. Self-healing if cracked.	Present worth of \$3,700,000.	Yes	
COLLECTION	Bulk Liquid Removal	Pumps/Industrial Vacuums	Removes existing and collected surface water. Water removed requires treatment prior to discharge.	Pumps and vacuum trucks are available and easily operated.	Low to moderate capital and maintenance costs. Present worth of \$20,000.	Yes	
TREATMENT	Physical Treatment	Activated Carbon Adsorption	Removes dissolved organics. Spent carbon adsorbent must be treated/disposed. System is proven reliable.	Proven and available technology. Metals must be removed prior to activated carbon treatment.	Moderate capital and operation and maintenance costs. Present worth of \$464,000.	Yes	
		Air (or Gas) Stripping	Removes volatile organic contaminants from water. Risks associated with BNA and inorganic contaminants are not reduced. VOC emissions require collection and GAC treatment.	Proven and available technology. May be used as pretreatment with other treatment technologies.	High capital and operation and maintenance costs. Present worth of \$1,210,000.	No	GAC provides similar treatment at less cost.



Table 4-3  
Page 3 of 5

General Response Action	Remedial Technology	Process Option	Effectiveness	Implementability	Cost	Retained	Rejection Rationale
TREATMENT (cont'd)		Steam Stripping	Removes volatile organic contaminants from water. Risks associated with stripping. Risks associated with BNA and inorganic contaminants are not reduced. System is proven reliable.	Proven and available technology. May be used as pretreatment with other treatment technologies.	High capital and operation and maintenance costs. Present worth of \$1,318,000.	No	GAC provides similar treatment at less cost.
		Coagulation, Flocculation and Sedimentation	Removes particulate-borne contaminants from water. Provides storage potential for contaminated water. Produces a sludge which must be treated/disposed. Risks associated with dissolved contamination are not reduced.	Technically feasible and available. May be necessary prior to other treatments.	Moderate capital and operation and maintenance costs. Present worth of \$550,000.		Yes
		Flotation	Removes particulate-borne contamination. "Froth" must be treated. Risks associated with dissolved contaminants are not reduced.	Proven and available technology. May be used as pretreatment with other treatment technologies.	Moderate capital and operation and maintenance costs.	No	Performs same function as sedimentation, but does not provide storage potential.
		Granular Media Filtration	Removes particulate-borne contaminants from water. Contaminants collected in filter must be treated/disposed. Risks associated with dissolved contaminants are not reduced.	Technically feasible and available. May be necessary prior to other treatments.	Low capital and operation and maintenance costs. Present worth included in coagulation/flocculation costs.	Yes	
	Chemical Treatment	Precipitation	Removes dissolved metals from water. Produces a sludge which must be treated/disposed. Risks associated with organic contaminants are not reduced.	Technically feasible and available. May be necessary prior to other treatments.	Low capital and operation and maintenance costs. Present worth included in coagulation/flocculation costs.	Yes	

Table 4-3  
Page 4 of 5

General Response Action	Remedial Technology	Process Option	Effectiveness	Implementability	Cost	Retained	Rejection Rationale
TREATMENT (cont'd)	Biological Treatment	Aerobic Biological Treatment	Reduces or eliminates volume and toxicity of organic contaminants. May not be effective for wide range of contaminants present. Spent biomass requires treatment/disposal.	Mobile treatment units are available. Specific biological reactor used will be determined at the design phase.	High capital and operation and maintenance costs. Estimated present worths of \$1,200,000, \$4,500,000 and \$7,100,000 for trickling filters, activated sludge, and rotating biological contactors. (RBCs), respectively.	No	Combination of physical treatment processes provides same function at significantly less cost.
		Anaerobic Biological Treatment	Reduces volume and toxicity of organic contaminants. Particularly effective for high concentrations of contaminants in water. May not be effective for wide range of contaminants present. Spent biomass requires treatment/disposal.	Mobile treatment units are available. Specific biological reactor used will be determined at the design phase.	Moderate capital and operation and maintenance costs.	No	Influent BOD would have to be augmented. Physical treatment provides same function at significantly less cost.
		New Biotechnologies	Reduces volume and toxicity of organic contaminants. Effective for concentrations found on site.	Mobile treatment units are available. Specific biological reactor used will be determined at the design phase.	Present worth (capital and O & M) of \$3,000,000.	No	Physical treatment provides same function at significantly less cost.
DISPOSAL	Wastewater Discharge	Discharge to POTW	Reduces low levels of contamination.	Significant distance to nearest POTW. Difficult to obtain administrative approval.	Moderate to high capital and operation and maintenance cost due to distance to POTW.	No	No POTW contacted will accept discharge.

Table 4-3  
Page 5 of 5

General Response Action	Remedial Technology	Process Option	Effectiveness	Implementability	Cost	Retained	Rejection Rationale
DISPOSAL (cont'd)		Discharge to Deep Injection Well	Permanently disposes of contaminated water. Isolates contamination from public, but does not affect toxicity or volume.	No existing wells in region would accept quantity to be disposed (40,000 gals./day)	Extremely high. \$5,000,000 for transportation alone.	No	Does not comply with intent of SARA. Water can be treated and discharged for a lower cost.
		Discharge to Surface Water	Does not reduce toxicity. Increases area of surface water contamination. Only applicable for delisted treatment products.	Requires construction of 3000 ft. of pipeline. Difficult to obtain administrative approval.	Moderate capital cost, low maintenance cost. Capital or operation and maintenance costs of \$112,000.	Yes	
		Discharge to RCRA Facility	RCRA treatment facility removes most, if not all, waterborne contaminants.	Significant distance to nearest RCRA treatment facility, but administratively feasible.	Low capital, but very high operation costs due to high transportation charges. Present worth \$26,000,000.	No	Onsite treatment significantly less expensive with similar results.
OTHER OPTIONS	Resident Relocation		Removes potential receptors from areas of contamination. Does not affect mobility, toxicity, or volume of contaminants.	May be difficult to implement from an administrative standpoint.	Moderate capital cost of \$38,000.	No	Surface water problem has been addressed by another action.

Potential groundwater remedial actions are limited due to complex hydrogeology at the site (see Appendix B). Contamination was detected in the Water Table Aquifer and the Upper Intermediate Unit. The hydraulic gradient in the contaminated region of the Upper Intermediate Unit is predominantly vertical with flow in a downward direction. In order to contain the contaminated groundwater in this unit and prevent contamination of the Upper Sharon Aquifer, it will be necessary to reverse the downward hydraulic gradient. Pumping of the Intermediate Unit directly would be ineffective for altering the gradient due to low predicted well yields (<1 gpm; see Appendix B). The only effective means of reversing the vertical gradient would be to eliminate the driving hydraulic head above the Intermediate Unit by dewatering the Water Table Aquifer within the site boundaries. Although this action will not completely reverse the gradient in the Upper Intermediate Unit, it should effectively stagnate the contaminated groundwater plume. Once stagnated, contaminated water from this unit can be collected and treated. Following are evaluations of specific technologies which could be used to perform this remedial action.

#### 4.5.1 No Action:

The NCP requires No Action to be carried through detailed analysis of alternatives.

#### 4.5.2 Access Restrictions:

As with the soil, sediment and subsurface waste operable unit, the purpose of access restrictions is to prevent exposure of receptors to contaminants. In the groundwater operable unit, deed restrictions are options that would be used to prevent future use of contaminated groundwater in the water table and Upper Intermediate Unit, and groundwater monitoring would be used to determine whether the contaminant plume is migrating off site. Groundwater monitoring would include the installation of new monitoring wells into the Upper Sharon Aquifer, new wells into the Upper Intermediate Unit, and appropriate analytical testing for a 30 year period. The estimated present worth of groundwater monitoring is about \$570,000. These options are considered technically viable and could be used in conjunction with other remedial technologies as part of a comprehensive remedial action at the site.

#### 4.5.3 Containment:

Viable groundwater containment technologies from the Chapter 3 screening include capping and vertical barriers. Capping was discussed under the soil/sediment/subsurface waste operable unit. The multi-layer cap was retained as an effective means of preventing infiltration and leaching of contaminants to groundwater.

Vertical Barriers: Slurry walls are the only vertical barrier technology carried forth from the initial screening. A soil-bentonite slurry wall approximately 3 ft. thick would be placed around the site perimeter to depths up to 40 ft. This would include about 6 ft. of penetration into the underlying bedrock to effect a good seal. The slurry wall would achieve a maximum permeability of approximately  $10^{-7}$  cm/sec., about one order of magnitude less than the surrounding soil. The soil-bentonite slurry wall is a proven technology which is considered effective and reliable in containing groundwater. The perimeter slurry wall at this site would prevent lateral migration off site of free product and groundwater. A 30 year present worth estimate for the soil-bentonite slurry wall is \$1,250,000. This technology will be carried forward for inclusion in remedial alternatives.

#### 4.5.4 Groundwater Collection

Groundwater collection could include a system of extraction wells and/or pipe and media drains. Calculations on which the systems analyzed were based are presented in Appendix C. For lowering of the groundwater table, it is estimated that an overall pumping rate of  $\pm 30$  gpm would be required. This estimate includes consideration of the effects of a cap and vertical barrier on the recharge rate of the groundwater table.

- a. Extraction Wells - Water Table Aquifer: Placing approximately 220 wells around the site perimeter and within the site would be sufficient to prevent downward migration of contaminants by lowering the water table to the top of rock. Extraction wells are considered effective and technically viable for groundwater collection, despite the fact that low soil permeabilities require the use of many wells in a grid pattern on closely spaced centers (50 ft.). Pumping would be required

indefinitely. Although reliability is good, regular maintenance and pump replacement would be required throughout the collection period. This action is expected to be implemented as a part of other activities such as treatment or disposal. The estimated 30 year present worth for extraction wells, pumps, and O & M is \$4,200,000 for a 30 gpm pumping system. This option will be included in the assembly of alternatives.

Free product would be collected by means of skimmer pumps placed in wells containing an immiscible phase. Non-floating free product should eventually be collected by the extraction wells. Once collected, free product would be drummed and treated, along with other drummed liquid waste. Skimmer pumps have been proven effective and reliable for the selective removal of a floating phase on groundwater. This technology will be retained for alternative assembly.

- b. Pipe and Media Drains - Water Table Aquifer: Pipe and media drains could be placed around the site perimeter, and also on 100 ft. centers throughout the site to lower the water level of the groundwater table. This would require the installation of a perimeter trench around the entire site and five equally spaced drains running in an east-west direction. These drains would have to extend to the top of rock to depths up to 30 ft. The cost of constructing trenches to this depth is much greater than for wells because the trench walls must be shored. The estimated cost for the construction of trenches around the perimeter and other trenches on 100 foot centers through the site connecting to the perimeter trench is \$7,400,000.

In addition, workers could be required to enter the contaminated zone to construct the trench drains. For these reasons, dewatering trenches will only be considered for alternatives which require excavation of all material to bedrock. In this case, the drain could be constructed by bringing it up concurrent with the uncontaminated material replaced in the excavation. Free product would be removed during excavation dewatering.

The pipe drain consists of a perforated collection pipe placed at the bottom of a trench backfilled with gravel. A geotextile fabric is placed on both sides of the trench to prevent migration of fine soil particles into the trench. These drains will collect water flowing into the site from either the perimeter or from below. Dewatering of the entire soil depth is possible with pipe and media drains if properly installed and operated. Pipe and media drains are considered reliable and effective in collecting contaminated groundwater or in controlling groundwater gradients. However, considering the close spacing of the trench drains, and the possible requirement for shoring, they are not considered technically feasible unless the entire soil zone is being excavated. If these drains are installed in conjunction with excavation of the entire soil zone, the total present worth of this option including construction, operation and maintenance is \$440,000. Pipe and media drains will be considered for use in alternatives in lieu of extraction wells when the entire soil zone is being excavated.

- c. Extraction Wells - Upper Intermediate Unit: After the contaminated groundwater in the Upper Intermediate Unit is stagnated, it could be extracted by means of wells. This would be accomplished by installing 12 wells on 100 ft. spacings into the Upper Intermediate Unit. These wells would be located on the southern portion of the site. Due to the low permeability of this unit, predicted well yields are about one gallon per minute. Complete restoration of the aquifer (removal of all contamination) would be slow; however, when combined with stagnation of the contaminant plume, this could be accomplished with minimal risk to public health. Contaminated water withdrawn would be treated and/or disposed. The estimated present worth cost (30 year period) for deep extraction wells is \$288,000. This option will be retained for assembly of alternatives.
- d. Radial Collection Wells - Water Table Aquifer: Lowering of the Water Table Aquifer could also be accomplished by the installation of 14 radial collector wells. Each well would consist of a 6-ft. diameter caisson hole to bedrock with ten 100 foot horizontal perforated well casings

extending radially from it. Construction of these collector wells would require a worker to enter and work from within the caisson in the contaminated zone. Health and safety risks would be greater than other options. Based on the high cost (approximately \$5,500,000 capital versus a total present worth of \$4,200,000 for wells) and health and safety risks, radial collection wells will be eliminated from further consideration.

#### 4.5.5 Groundwater Treatment:

Various waste treatment technologies were previously discussed in the surface water operable unit. Groundwater treatment would require the addition of an oil-water separator to the treatment system.

Oil-Water Separation: A simple gravity separator could be used to remove free product from the extracted groundwater. The extracted product would be drummed and shipped to an offsite facility for reclamation, treatment, or incineration. The additional 30 year present worth cost estimated to add an oil-water separator to the treatment system is about \$23,000. This option will be retained for alternative assembly.

#### 4.5.6 Groundwater Discharge:

Discharge technologies were previously described in the surface water operable unit. The POTW, RCRA facility, and deep well injection options were eliminated from further evaluation. Discharge of treated water to nearby surface drainage courses will be considered for remedial alternatives.

#### 4.5.7 Other Management Options

Other management options applicable to the groundwater operable unit are development of an alternative drinking water supply, individual home treatment, and resident relocation. The only residence affected by contaminated drinking water is the Watson residence. It was decided previously that for adequate protection from soil contaminants, the Watson home should be relocated. In doing so, the groundwater contamination problem will also be rectified with the installation of a new well to uncontaminated groundwater, the cost of which is estimated to be \$6,000. As such, further consideration of an alternate drinking water supply and

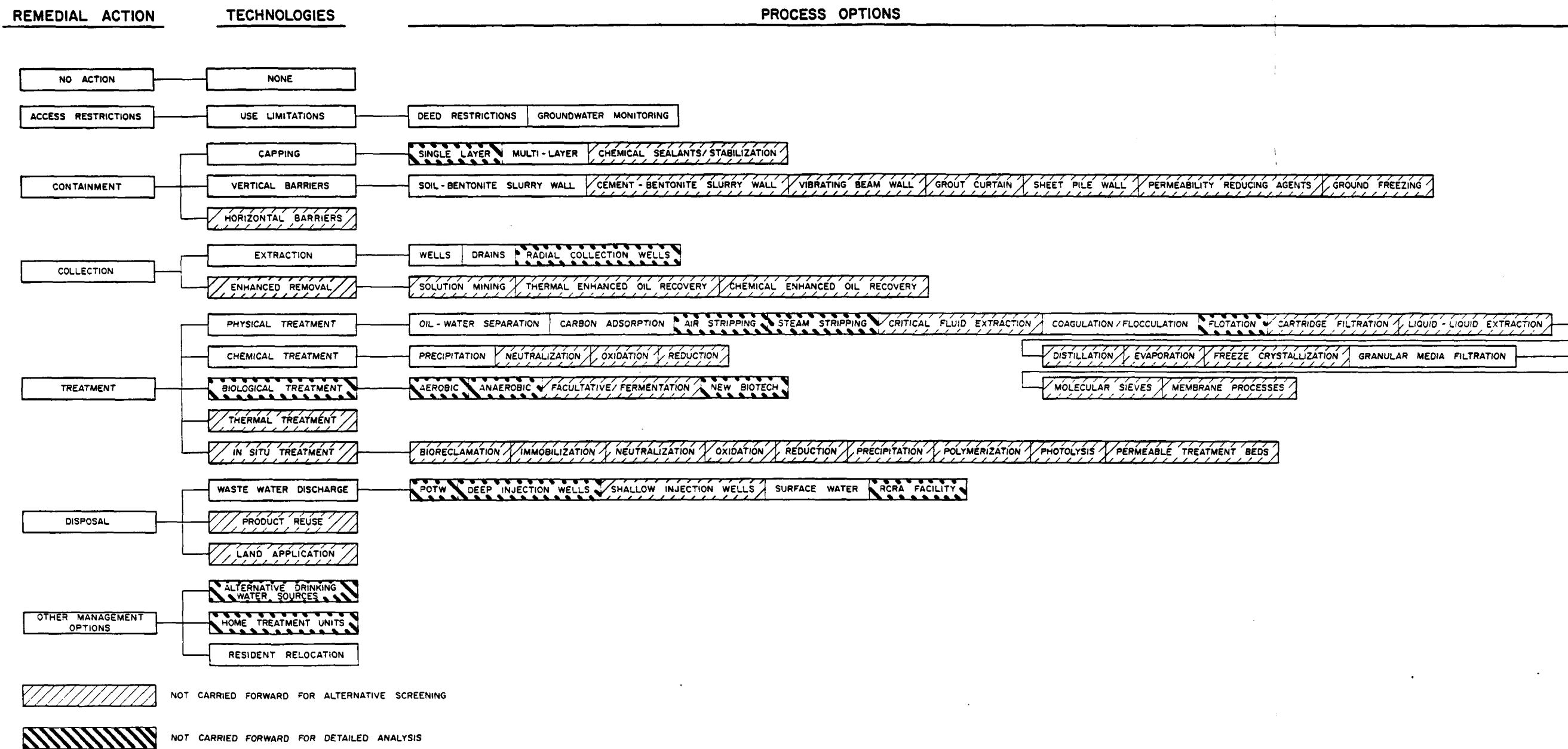


individual treatment units is not necessary. Resident relocation will be retained for assembly of alternatives.

The technology screening for the groundwater operable unit is summarized on Figure 4-5 and Table 4-4.

TABLE 4-4  
SUMMARY OF APPLICABLE TECHNOLOGY SCREENING  
GROUNDWATER OPERABLE UNIT  
SUMMIT NATIONAL FEASIBILITY STUDY

General Response Action	Remedial Technology	Process Option	Effectiveness	Implementability	Cost	Retained	Rejection Rationale
NO ACTION	None		Risks are identified in the Environment and Public Health Risk Assessment.	--	None	Yes	
ACCESS RESTRICTIONS	Use Limitations	Deed Restrictions	May reduce risk of direct contact with contaminated groundwater. Does not reduce risks associated with migration of contaminated groundwater.	Easily implemented.	Little or no capital cost.	Yes	
	Monitoring	Ground-water Monitoring	Used to detect migration of the contaminant plume. Does not reduce mobility, toxicity, or volume.	Monitoring well installation is widely accepted practice.	Moderate capital and operation and maintenance costs. Present worth of \$570,000.	Yes	
	Capping	Single Layer Cap	Reduces mobility of contaminants and risk of direct contact; however, contaminants remain on site. Restrictions on future use required. Some materials incompatible with onsite	Construction is relatively simple. Potential for cracking due to freeze-thaw cycles.	Low capital cost relative to other capping alternatives. High maintenance cost due to frequent cracking. Present worth of \$1,200,000.	No	Does not provide adequate protection against leaching.
CONTAINMENT		Multi-Layer Cap	Reduces mobility of contaminants and risk of direct contact; however, contaminants remain on site. Restrictions on future use required.	Construction is relatively complex and time consuming. Least susceptible to cracking. Self-healing if cracked.	Present worth of \$3,700,000	Yes	
	Vertical Barriers	Soil-Bentonite Slurry Wall	Reduces lateral flow of groundwater. Toxicity and volume of contamination is unaffected. Downward vertical gradient in contaminated aquifer limits effectiveness of vertical barriers.	Construction techniques are well developed. May be difficult to achieve permeability significantly lower than that of the surrounding units.	Capital cost of \$1,250,000. Low maintenance cost.	Yes	



REFER TO TABLES 3-8 AND 4-4 FOR SCREENING DISCUSSIONS

FIGURE 4-5  
GROUNDWATER TECHNOLOGIES  
SUMMIT NATIONAL FS

Table 4-4  
Page 2 of 6

General Response Action	Remedial Technology	Process Option	Effectiveness	Implementability	Cost	Retained	Rejection Rationale
COLLECTION	Extraction	Extraction Wells (in Water Table)	Pumping of the Watertable Aquifer to reduce hydraulic head can effectively immobilize contaminated groundwater in the Upper Intermediate Unit. Water pumped from Watertable Aquifer will require treatment/disposal, as will associated free product skimmed from wells.	Due to low permeability a large number of wells are required. Drilling and pumping technologies are standard.	High capital and operation and maintenance costs. Present worth of \$4,200,000.	Yes	
		Extraction Wells (in Upper Intermediate Unit)	Pumping of the Upper Intermediate Unit would reduce deep groundwater contamination. Rate of extraction would be slow.	Due to low permeability, a large number of wells is required. Drilling and pumping technologies are standard.	High capital and operation and maintenance costs. Present worth of \$290,000.	Yes	
		Drains	Drains can be used to collect water from the Watertable Aquifer for treatment.	Construction is well developed. Depth of drains is limited.	Present worth of \$440,000 when all soil is excavated. \$7,400,000 when installed with vadose zone or "hot-spot" excavation.	Yes	
		Radial Collector Wells	Could be effectively used to dewater the Water Table Aquifer. Not applicable for construction in bedrock.	Construction techniques are complex. Workers would be required to work within caissons in contaminated material.	High capital and operation and maintenance costs. Capital cost of \$5,500,000.	No	Unacceptable health and safety risks to workers. Cost higher than conventional wells for dewatering Water Table Aquifer.

Table 4-4  
Page 3 of 6

General Response Action	Remedial Technology	Process Option	Effectiveness	Implementability	Cost	Retained	Rejection Rationale
TREATMENT	Physical Treatment	Oil-Water Separation	Removes free oil from groundwater. Risks associated with other organic and inorganic contaminants are not reduced. Oil requires treatment/disposal.	Proven and available technology. May be necessary prior to other treatments.	Low capital and operation and maintenance costs. Present worth of \$23,000	Yes	
		Activated Carbon Adsorption	Removes dissolved organics. Spent carbon adsorbent must be treated/disposed. System is proven reliable.	Proven and available technology. Metals must be removed prior to activated carbon treatment.	Moderate capital and operation and maintenance costs. Present worth of \$464,000.	Yes	
		Air or Gas Stripping	Removes volatile organic contaminants from water. Risks associated with BNA and inorganic contaminants are not reduced. System is proven reliable.	Proven and available technology. May be used as pretreatment with other treatment technologies.	High capital and operation and maintenance costs. Present worth of \$1,210,000.	No	GAC provides similar treatment at less cost.
		Steam Stripping	Removes volatile organic contaminants from water. Risks associated with stripping. Risks associated with BNA and inorganic contaminants are not reduced. System is proven reliable.	Proven and available technology. May be used as pretreatment with other treatment technologies.	High capital and operation and maintenance costs. Present worth of \$1,318,000.	No	GAC provides similar treatment at less cost.
		Coagulation, Flocculation and Sedimentation	Removes particulate-borne contamination from water. Provides storage potential for contaminated water. Produces a sludge which must be treated/disposed. Risks associated with dissolved contamination are not reduced.	Technically feasible and available. May be necessary prior to other treatments.	Moderate capital and operation and maintenance costs. Present worth of \$550,000.	Yes	
		Flotation	Removes particulate-borne contamination. "Froth" must be treated. Risks associated with dissolved contaminants are not reduced.	Proven and available technology. May be used as pretreatment with other treatment technologies.	Moderate capital and operation and maintenance costs.	No	Performs same function as sedimentation, but does not provide storage potential.

Table 4-4  
Page 4 of 6

General Response Action	Remedial Technology	Process Option	Effectiveness	Implementability	Cost	Retained	Rejection Rationale
TREATMENT (cont'd)		Granular Media Filtration	Removes particulate-borne contaminants from water. Contaminants collected in filter must be treated/disposed. Risks associated with dissolved contaminants are not reduced.	Technically feasible and available. May be necessary prior to other treatments.	Low capital and operation and maintenance costs. Present worth included in coagulation/flocculation costs.	Yes	
	Chemical Treatment	Precipitation	Removes dissolved metals from water. Produces a sludge which must be treated/disposed. Risks associated with organic contaminants are not reduced.	Technically feasible and available. May be necessary prior to other treatments.	Low capital and operation and maintenance costs. Present worth included in coagulation/flocculation costs.	Yes	
	Biological Treatment	Aerobic Biological Treatment	Reduces or eliminates volume and toxicity of organic contaminants. May not be effective for wide range of contaminants present. Spent biomass requires treatment/disposal.	Mobile treatment units are available. Specific biological reactor used will be determined at the design phase.	High capital and operation and maintenance costs. Present worths of \$1,200,000, \$4,500,000, and \$7,100,000 for trickling filters, activated sludge, and RBCs, respectively.	No	Combination of physical treatment processes provides same function at significantly less cost.
		Anaerobic Biological Treatment	Reduces volume and toxicity of organic contaminants. Particularly effective for high concentrations of contaminants in water. May not be effective for wide range of contaminants present. Spent biomass requires treatment/disposal.	Mobile treatment units are available. Specific biological reactor used will be determined at the design phase.	Moderate capital and operation and maintenance costs.	No	Influent BOD would have to be augmented. Physical treatment provides same function at significantly less cost.

Table 4-4  
Page 5 of 6

General Response Action	Remedial Technology	Process Option	Effectiveness	Implementability	Cost	Retained	Rejection Rationale
TREATMENT (cont'd)		New Bio-technologies	Reduces volume and toxicity of organic contaminants. Effective for concentrations found on site.	Mobile treatment units are available. Specific biological reactor used will be determined at the design phase.	Present worth (capital and O & M) of \$3,000,000.	No	Physical treatment provides same function at significantly less cost.
DISPOSAL	Wastewater Discharge	Discharge to POTW	Reduces low levels of contamination.	Significant distance to nearest POTW. Difficult to obtain administrative approval.	Moderate to high capital and operation and maintenance cost due to distance to POTW.	No	No POTW contacted will accept discharge.
		Discharge to Deep Injection Well	Permanently disposes of contaminated water. Isolates contamination from public, but does not affect toxicity or volume.	No existing wells in region would accept quantity to be disposed (11,000 gals./day)	Extremely high. \$5,000,000 for transportation alone.	No	Does not comply with intent of SARA. Water can be treated and discharged for a lower cost.
		Discharge to Surface Water	Does not reduce toxicity. Increases area of surface water contamination. Only applicable for delisted treatment products.	Requires construction of 3000 ft. of pipeline. Difficult to obtain administrative approval.	Moderate capital cost, low maintenance costs. Capital and operation and maintenance costs of \$112,000.	Yes	
		Discharge to RCRA Facility	RCRA treatment facility removes most, if not all, waterborne contaminants.	Significant distance to nearest RCRA treatment facility, but administratively feasible.	Low capital, but very high operation costs due to high transportation charges. Present worth \$26,000,000.	No	Onsite treatment significantly less expensive with similar results.

Table 4-4  
Page 6 of 6

General Response Action	Remedial Technology	Process Option	Effectiveness	Implementability	Cost	Retained	Rejection Rationale
OTHER OPTIONS		Alternate Drinking Water Supply	Provides potential receptors with a safe source of drinking water. Does not affect mobility, toxicity, or volume of contaminants.	--	--	No	Resident relocation necessary for protec- tion from exposure to contami- nated soil. This option would be redundant.
		Individual Home Treat- ment Units	Provides potential receptors with safe drinking water. Effective- ness is dependent on selection of and maintenance of treatment unit.	--	--	No	Resident relocation necessary for protec- tion from exposure to contami- nated soil. This option would be redundant.
		Resident Relocation	Removes potential receptors from areas of contamination. Does not affect mobility, toxicity, or volume of contaminants.	May be difficult to implement from an administrative stand- point.	Moderate capital cost of \$38,000	Yes	



## CHAPTER 5

### ALTERNATIVES DEVELOPMENT

#### ASSEMBLY AND DETAILED DESCRIPTION OF ALTERNATIVES

Technologies surviving the screening presented in Chapter 4 are assembled into remedial action alternatives in this chapter. Since 17 technologies with 28 associated process options remain, the number of potential combinations of each alternative relative to the overall remedial action goals and objectives is presented. The following detailed descriptions of the assembled alternatives present information on process options included and the effects of each proposed technology on the operable units at the site.

Table 5-1 presents the matrix of the surviving technologies and the alternatives assembled for detailed analysis. Numerous variations and combinations of the alternatives exist which may be considered when selecting the preferred alternative. A discussion of the objectives of each alternative relative to the overall remedial action goals and objectives is presented. The following detailed descriptions of the assembled alternatives present information on process options included and the effects of each proposed technology on the operable units at the site.

#### ALTERNATIVE NO. 1 - NO ACTION

The No Action alternative is required by the NCP to be carried through to detailed analysis of alternatives and provides a baseline for comparison of other alternatives. This alternative would result in the public health and environmental risks identified in the public health evaluation included in the RI and the risk assessment summarized in Chapter 2 of this report.

#### ALTERNATIVE NO. 2 - RESIDENT RELOCATION WITH MONITORING

The major components of Alternative 2 are:

- o Access/Deed Restrictions
- o Runoff Monitoring
- o Groundwater Monitoring
- o Relocation of Watson Residence

TABLE 5-1  
ALTERNATIVES DEVELOPMENT  
SOIL, SEDIMENT, SUBSURFACE WASTE, SURFACE WATER AND GROUNDWATER OPERABLE UNITS  
SUMMIT NATIONAL FEASIBILITY STUDY

	1	2	3	4	5	6	7	8	9
	No Action	Resident Relocation with Monitoring	Capping with Drum Incineration	RCRA Landfill for Vadose Soil	Thermal Treat "Hot Spot" Soil	Thermal Treat Vadose Soil	Thermal Treat All Unconsolidated Material	In-Situ Vitrification of "Hot Spot" Soil	In-Situ Vitrification of Vadose Soil
<u>Access Restrictions</u>									
Deed Restrictions & Site Fencing		X	X	X	X	X	X	X	X
Runoff Monitoring		X	X	X	X	X	X	X	X
Groundwater Monitoring		X	X	X	X	X	X	X	X
<u>Containment</u>									
Surface Controls - Grading									
Revegetation, Diversion and Collection Systems			X	X	X	X	X	X	X
Multi-Layer Cap			X	X	X	X	X		
Soil-Bentonite Slurry Wall			X	X	X	X	X	X	X
<u>Collection</u>									
Wells to Water Table Aquifer			X	X	X	X		X	X
Pipe and Media Drains in Water Table Aquifer							X		
Wells in Upper Intermediate Unit			X	X	X	X	X	X	X
Skimmer Pumps for Free Product			X	X	X	X	X	X	X
<u>Removal</u>									
Excavation of Drums and Tanks			X	X	X	X	X	X	X
Excavation of Sediment			X	X	X	X	X	X	X
Excavation of "Hot Spot" Soil				X	X				
Excavation of All Vadose Contamination				X		X			
Excavation of All Unconsolidated Material							X		
Structure Demolition			X	X	X	X	X	X	X

TABLE 5-1  
Page 2

	1	2	3	4	5	6	7	8	9
	No Action	Resident Relocation with Monitoring	Capping with Drum Incineration	RCRA Landfill for Vadose Soil	Treat "Hot Spot" Soil	Thermal Treat Vadose Soil	Thermal Treat All Unconsolidated Material	In-Situ Vitrification of "Hot Spot" Soil	In-Situ Vitrification of Vadose Soil
<u>Treatment</u>									
Thermal Treatment of Drummed Material			X	X	X	X	X	X	X
Thermal Treatment of "Hot Spot" Soil					X				
Thermal Treatment of All Vadose Contamination						X			
Thermal Treatment of All Unconsolidated Material							X	X	
In-Situ Vitrification of "Hot Spot" Soil									
In-Situ Vitrification of Vadose Soil									X
Water Treatment (Oil-water separation, coagulation, flocculation, sedimentation, filtration, GAC)			X	X	X	X	X	X	X
<u>Disposal</u>									
Onsite Soil Replacement					X	X	X		
Onsite RCRA Landfill				X	X	X	X		
Water Discharge to Surface Water			X	X	X	X	X	X	X
<u>Other Management Options</u>									
Relocation of Watson Residence		X	X	X	X	X	X	X	X

This alternative is intended to represent a minimum action alternative which would offer protection for that portion of the public currently at a direct risk from known existing site hazards. The potential risks that the residents located along the eastern perimeter are exposed to are in excess of a  $10^{-6}$  total cancer risk. The mobility, toxicity, or volume of the wastes or contaminated materials is unaffected by this alternative, and the major existing contaminant source (buried drums and tanks) would remain unremediated and on site. The site plan for Alternative 2 is shown on Figure 5-1. This alternative could be implemented in less than one year.

#### Access/Deed Restrictions

Deed restrictions would be placed on the site property. The restrictions would prevent future development of the land to protect against direct contact with contaminants or further migration that would result from site excavation. The deed restrictions would also prohibit use of groundwater or installation of water supply wells on site. Access to the site would be controlled by extending the existing fencing around the site perimeter 100 ft. south and 150 ft. east, as shown on Figure 5-1, to enclose all identified contaminated areas.

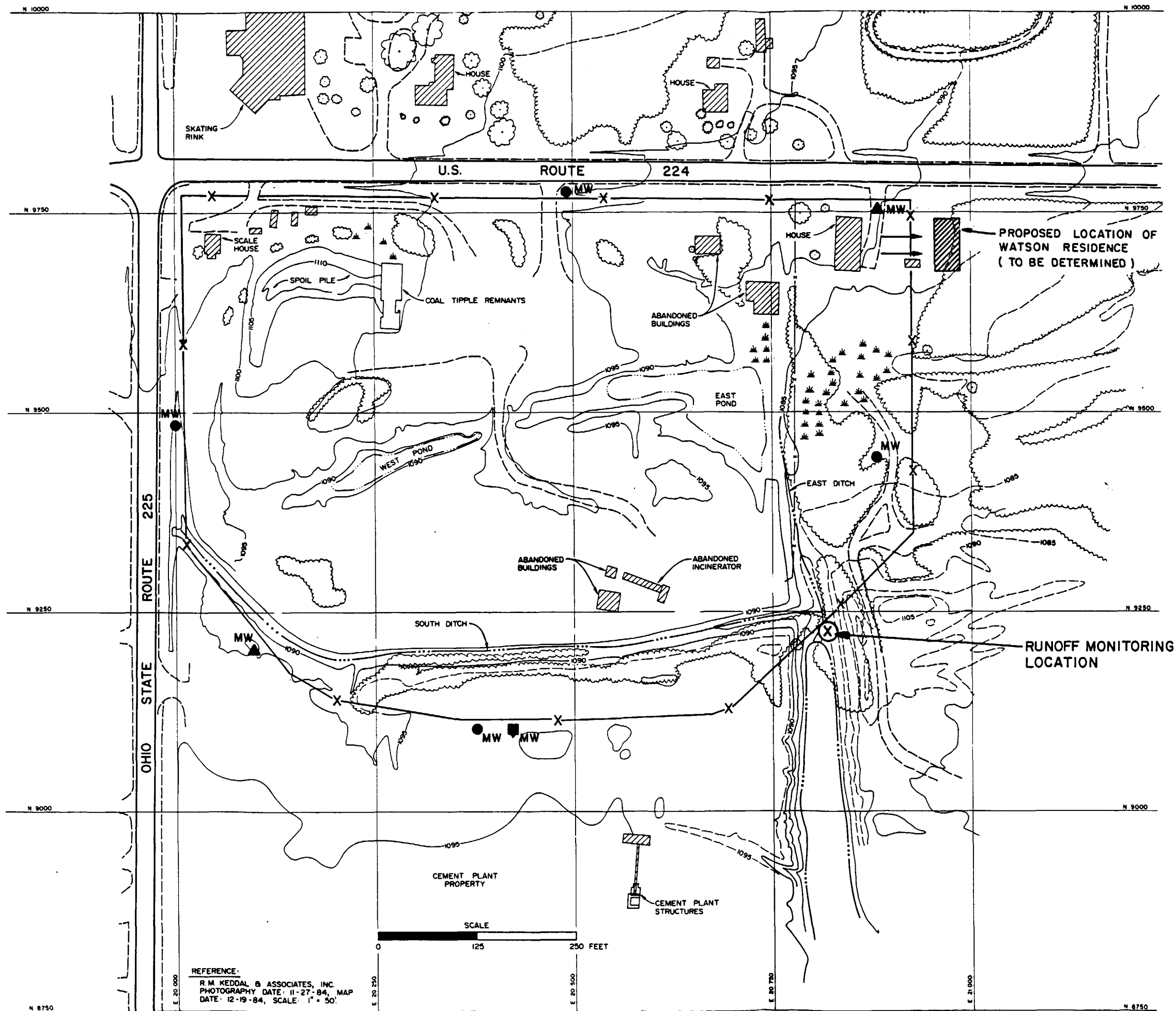
#### Runoff Monitoring

Surface water and sediment samples would be collected and analyzed on a quarterly basis from the controlled pond discharge at the southeast corner of the site. Following the Emergency Response Action in Spring, 1987, all surface water from the site currently flows to the central ponds and overflow is discharged to the lower east drainage ditch. Monitoring would be used to detect migration of surface soil and sediment contamination from the site, which would signal the need for further remedial action to adequately protect public health and the environment. Monitoring would be an ongoing activity as long as contaminants remained on site.

#### Groundwater Monitoring

Future contaminant migration would be assessed through a regular groundwater monitoring program. The groundwater monitoring program will consist of quarterly samples of seven monitoring wells for a 30-year period, including:

- o One new upgradient and one new downgradient monitoring well screened in the Upper Sharon;



# **LEGEND**

- X—X SITE FENCE DELINEATING AREA OF DEED RESTRICTIONS
- (X) RUNOFF MONITORING LOCATION
- MW WATER TABLE MONITORING WELL
- MW INTERMEDIATE UNIT MONITORING WELL
- MW UPPER SHARON AQUIFER MONITORING WELL



SCALE IN FEET  
APPROXIMATE

**FIGURE 5-1  
ALTERNATIVE 2  
RESIDENT RELOCATION  
WITH MONITORING**

**SITE PLAN  
SUMMIT NATIONAL FS**

- o Two new and two existing monitoring wells screened in the Water Table Aquifer, one at each site boundary; and
- o One new monitoring well screened in the Intermediate Unit.

Samples would be analyzed for contaminants in accordance with 40 CFR 264-.92 to .94. Detection of contaminant migration toward potable water sources would indicate the need for additional remedial actions such as development of alternate drinking water sources or individual home treatment units.

#### Relocation of Watson Residence

The Watson residence, located within the proposed relocated eastern site boundary, requires relocation due to the risk associated with exposure to soils and the implementation of the remedy for the site. This action would reduce the occupants' risk of direct contact or ingestion of contaminated groundwater and surface soils. It is estimated that two acres (600 x 150 ft.) would need to be purchased from the Watsons. This area would serve as a buffer between the site and the remainder of the Watson property and would secure the contaminated eastern perimeter soils. Provisions for services such as a drinking water supply depends on the method of relocation. The exact terms of the relocation will be discussed with the affected parties before a decision is made. It is likely that any relocation will require the involvement of both Ohio EPA and the Federal Emergency Management Agency (FEMA).

#### ALTERNATIVE NO. 3 - CAPPING WITH DRUM INCINERATION

The major components of Alternative 3 are:

- o Access/Deed Restrictions
- o Runoff Monitoring
- o Groundwater Monitoring
- o Removal of Structures
- o Excavation and Incineration of Buried Drums and Tanks
- o Excavation of Sediment and Placement Under Cap
- o Multi-Layer Cap
- o Vertical Barrier and Groundwater Extraction Wells
- o Elimination of Onsite Surface Water
- o Water Treatment
- o Relocation of Watson Residence

All operable unit goals are addressed in this alternative. It is intended to be representative of a low-cost containment alternative that offers protection to public health and environment from existing site hazards. The mobility, toxicity, or volume of the wastes or contaminated materials are reduced by this alternative by the incineration of buried drum and tank contents which are a remaining source of concentrated onsite contaminants. The site plan and cross-section of Alternative 3 are shown on Figures 5-2 and 5-3, respectively. Access restrictions, groundwater monitoring and resident relocation would be the same as discussed for Alternative 2. As with Alternative 2, this alternative could also be implemented in less than a year.

#### Runoff Monitoring

Surface water and sediment samples would be collected and analyzed on a quarterly basis from the southeast discharge point of the relocated south ditch and at the entrance to the first impoundment. As shown on Figure 5-3, drainage from the cap is directed southeast and into the relocated ditch and the first impoundment. Monitoring would be used to detect migration of surface soil and sediment contamination from the site, which would signal the need for further remedial action to adequately protect public health and the environment. Monitoring would be performed for a 30 year period.

#### Removal of Structures

The existing onsite aboveground structures, including the old incinerator building, will be demolished. The debris from the demolished structures will be removed from the site and disposed in permitted offsite facilities or left on site under the cap. This operation does not mitigate site hazards for any operable unit, but are necessary to implement other remedial actions.

Additionally, the material composing the tibble mound will be used to grade the site, eliminating the mound which is currently inconsistent with final grading plans.

#### Excavation and Incineration of Buried Drums and Tanks

The buried drums located on site will be excavated, brought to the surface and transported off site for incineration. The buried tanks will be emptied and contents transported off site for incineration, then the tanks will be exposed, brought to the surface, and disposed of in the same manner as the drums. Although the drums exposed during the RI

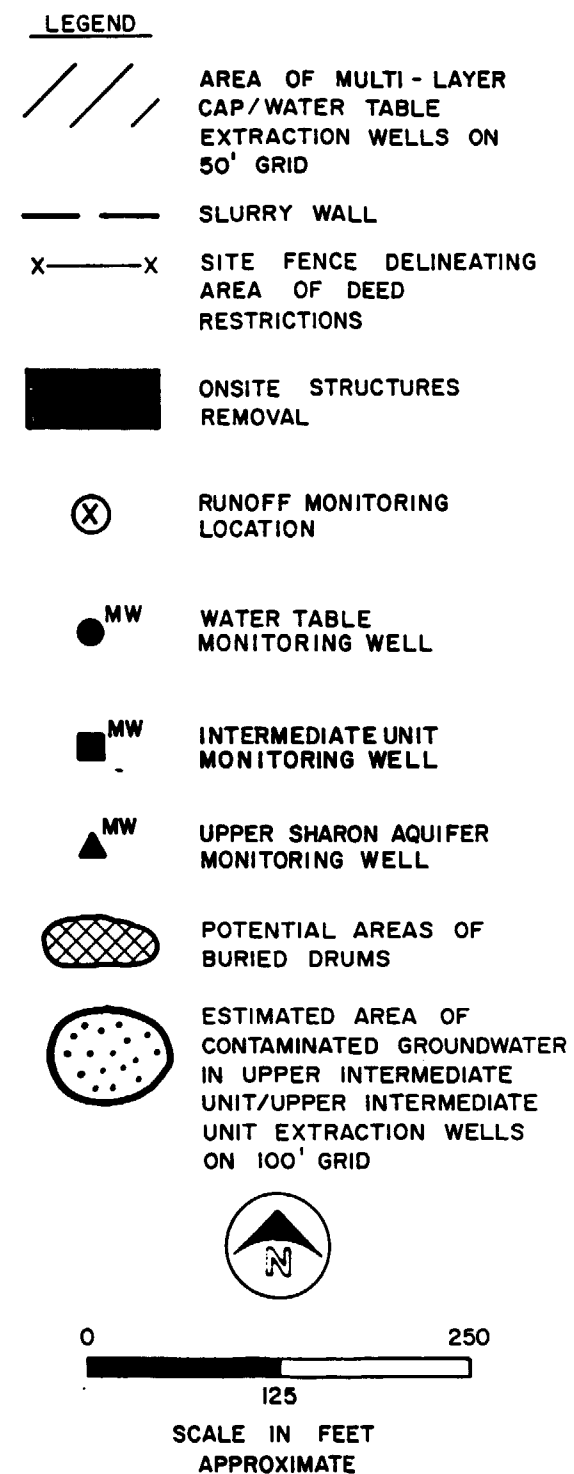
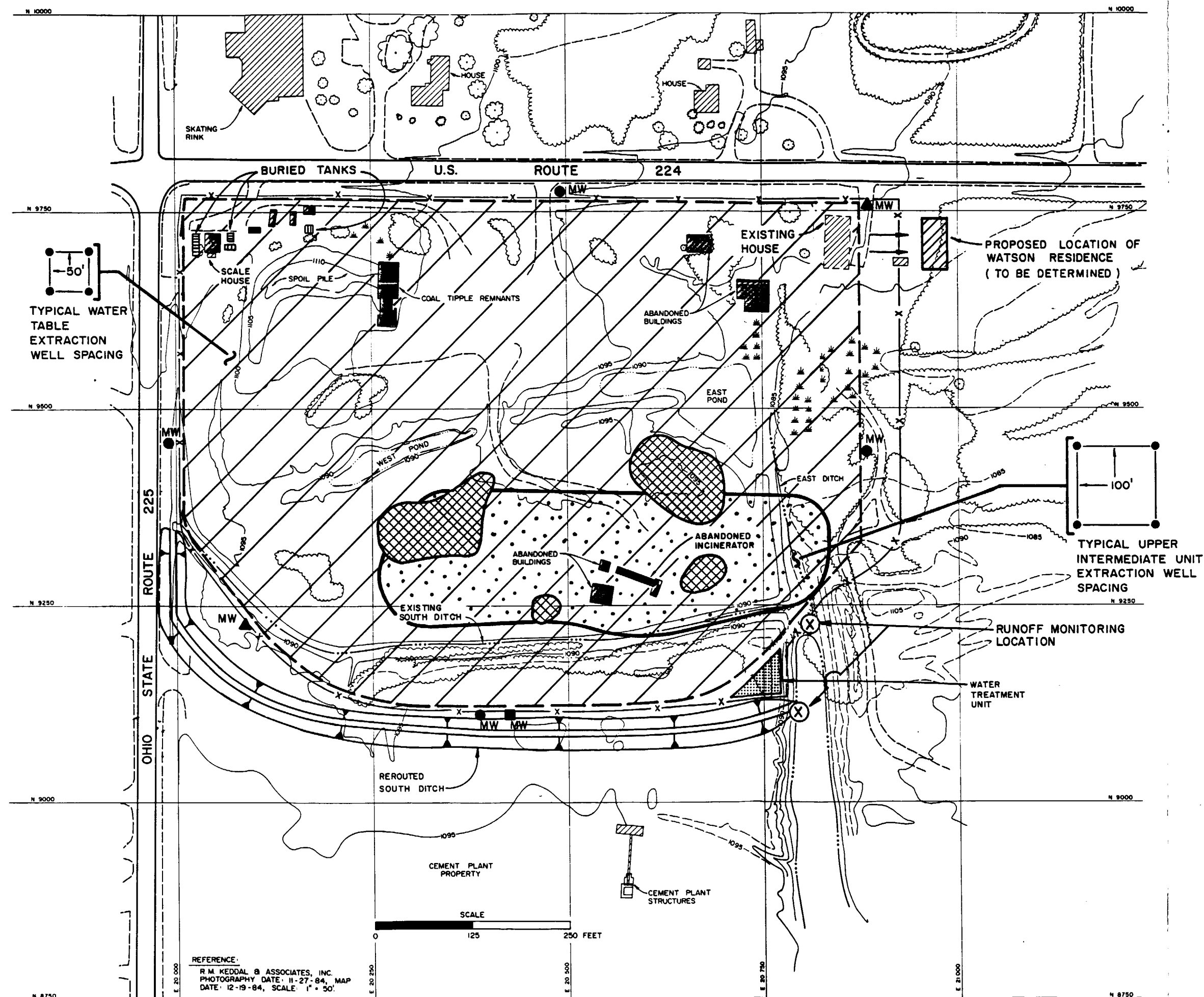


FIGURE 5-2  
ALTERNATIVE 3  
CAPPING WITH DRUM INCINERATION  
SITE PLAN  
SUMMIT NATIONAL FS



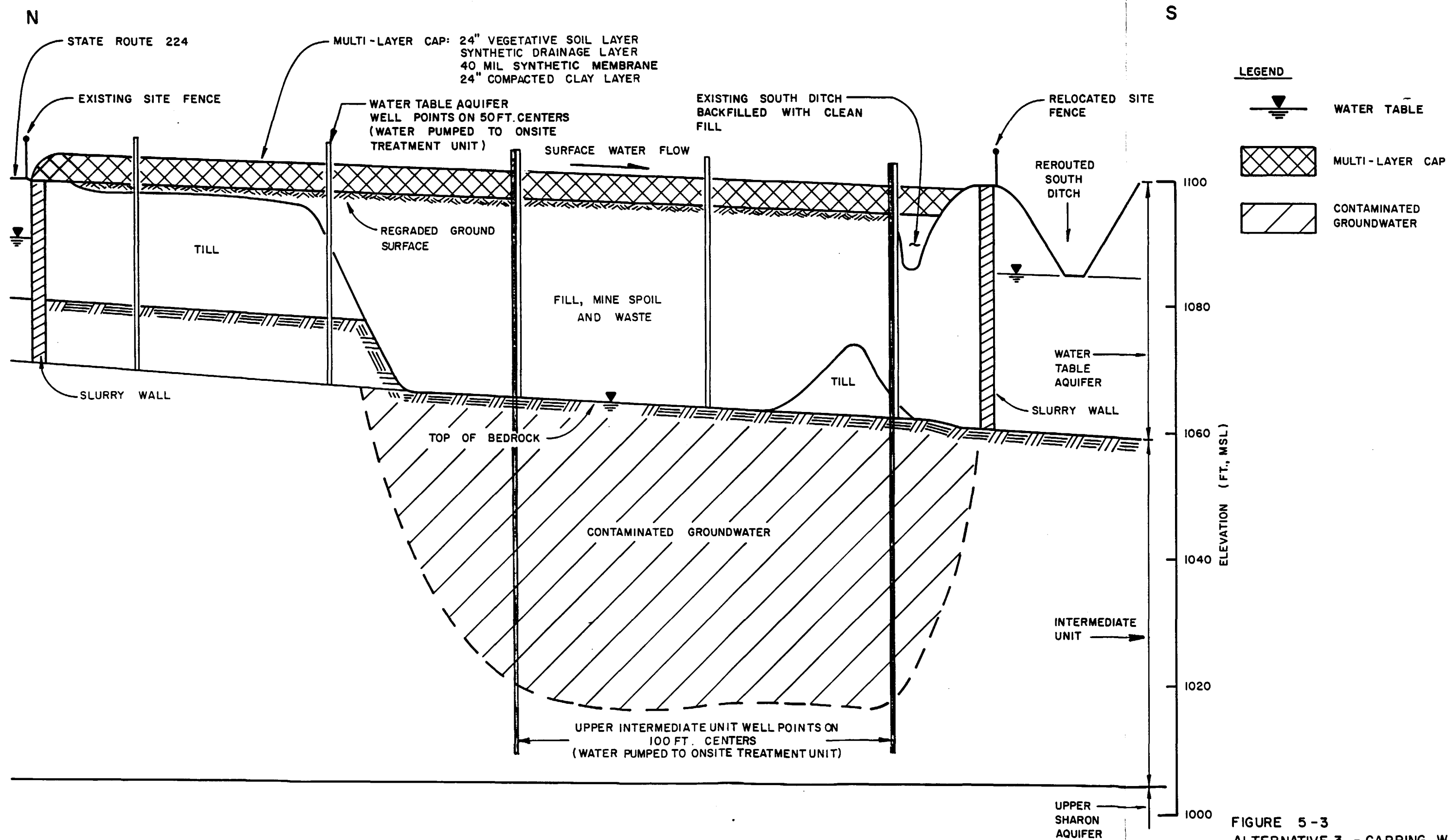


FIGURE 5-3  
ALTERNATIVE 3 - CAPPING WITH  
DRUM INCINERATION  
GENERALIZED NORTH - SOUTH  
CROSS SECTION  
SUMMIT NATIONAL FS

were generally intact, it was assumed that 25% of the drums will require overpacking prior to transportation off site. The drummed materials presently constitute a remaining onsite contaminant source, and future leaks in the drums could release concentrated contaminants into the soils. This release could both increase dermal contact hazards associated with the site and increase the contaminant load to the onsite groundwater. Removal of the drums and tanks will eliminate these risks.

#### Excavation of Sediment and Placement Under Cap

The sediments located in the lower east ditch, the east ditch within the relocated site boundary, the south ditch, and the first impoundment will be excavated and placed onsite for containment under the proposed multi-layer cap. These contaminated materials will be used to establish the rough site grading prior to construction of the cap.

#### Multi-Layer Cap

A multi-layer cap would be installed over contaminated areas to prevent direct contact with surface contaminants and prevent their erosion and transport to offsite areas. The capped area will extend 100 ft. south and 100 ft. east of the existing fence line to cover all identified areas of contamination. The multi-layer cap would consist of, from top to bottom, 1 ft. of topsoil-like loam, 1 ft. of clean earth fill, filter fabric, high density polyethylene (HDPE) drainage net, 40 mil HDPE liner, and a 2 ft. compacted clay layer (see Figure 5-4). The cap would increase evapotranspiration through establishment of a vegetative cover, thereby reducing the volume of infiltration moving through the contaminated vadose soils. This will, in turn, reduce the mobility of contaminants transported into the groundwater. Prior to placing the cover, the site would be graded to fill existing depressions, eliminate sharp grade changes, and provide for site drainage to prevent water ponding on site. Multi-layer cap construction is discussed in greater detail in Chapter 4.

It was assumed that maintenance, consisting of replacement of 30% of the vegetative layer, regrading, and revegetation, would be required every ten years. Bimonthly inspections would also be performed to detect possible cracking or damage to the cap.

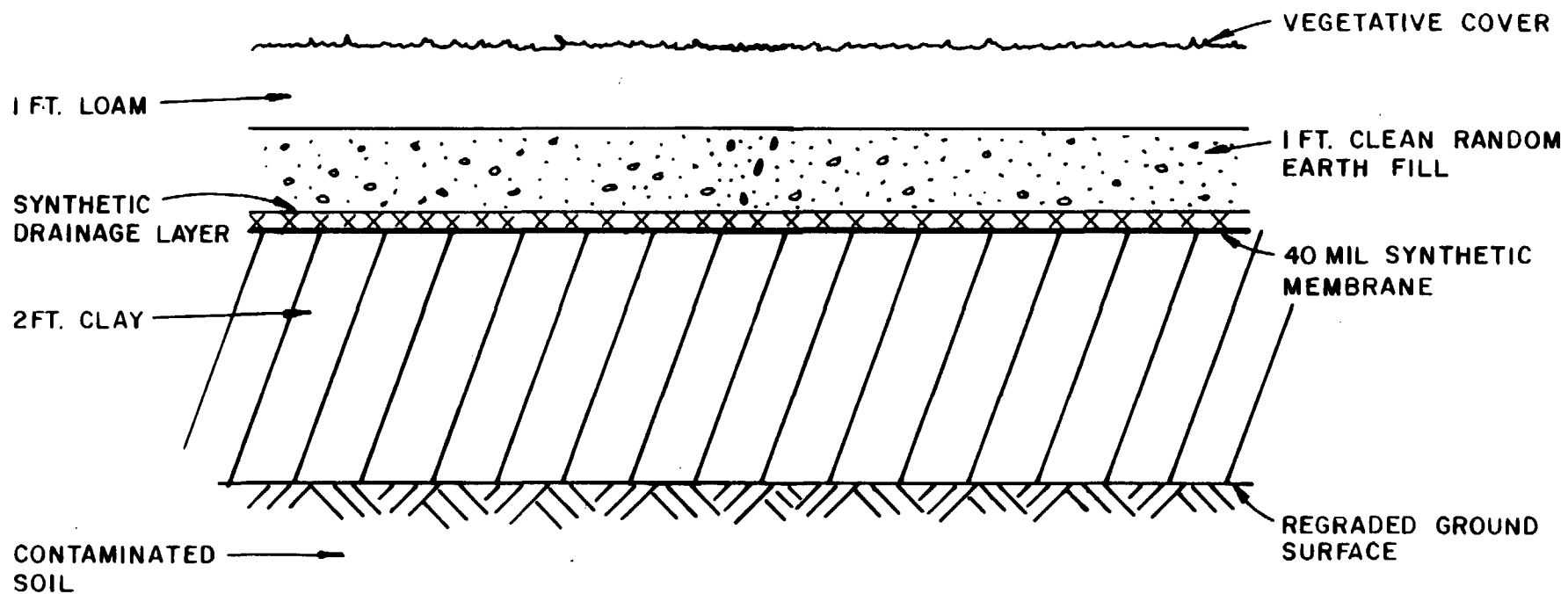


FIGURE 5-4  
MULTI-LAYER CAP  
SUMMIT NATIONAL FS

## Vertical Barrier and Groundwater Extraction

A vertical barrier (soil-bentonite slurry wall) will be installed around the perimeter of the site, as shown on Figure 5-2, to reduce horizontal groundwater movement in the Water Table Aquifer. On the upgradient side of the site, the barrier will reduce the volume of uncontaminated water moving into the contaminated area beneath the site where leaching of contamination will occur. The barrier also reduces the volume of contaminated groundwater which is moving downgradient away from the site in the Water Table Aquifer. Additionally, the barrier will reduce the volume of water which will need to be collected and treated by the groundwater extraction system.

The extraction of water from the Water Table Aquifer will be performed using a system of 220 wells, located throughout the site on 50 ft. centers, to collect the water and lower the piezometric surface to the top of bedrock. The groundwater extraction will enhance the barrier performance by reducing the gradient which is currently causing offsite groundwater movement to the south and east. Groundwater extraction will be performed within the limits of the vertical barrier to enhance the barrier performance and to reduce the rate of vertical contaminant migration downward toward the Upper Intermediate Unit. The performance and effects of this system are discussed in Appendices B and C. Additionally, the lowering of the water level to the top of bedrock will reduce the rate of vertical contaminant movement in the Upper Intermediate Unit downward toward the Upper Sharon Aquifer.

Contaminated groundwater in the Upper Intermediate Unit will also be collected by wells. Twelve (12) wells will be installed in a grid pattern on 100 ft. centers within the area of groundwater contamination, as shown on Figure 5-2. These wells will extract the contaminated groundwater, and should lead to eventual aquifer restoration in as little as 5 years, as discussed in Appendices B and C.

Water extracted will be treated on site in a 50 gpm treatment unit in accordance with the technologies discussed under water treatment.

Free product detected in the south central portion of the site will be extracted by means of skimmer pumps installed in 8 conventional wells in the affected area. Non-floating free product would probably eventually be collected by the normal process of dewatering the aquifer. Free product collected will be drummed and temporarily staged on site. At established intervals throughout the groundwater extraction program, these drums will be shipped off site and incinerated.

### Elimination of Onsite Surface Water

Elimination of onsite surface water will involve the draining and backfilling of the two onsite ponds and the relocation of the southern perimeter ditch to the south about 100 ft. to move it beyond the limits of identified contamination. The pumping and backfilling of the ponds eliminates one source of identified contaminant migration since the ponds have periodically overflowed and discharged off site. Water from the ponds will be treated by the same system used to treat the discharge water from the groundwater extraction system. The relocation of the ditch will require the acquisition of about two acres of the present cement plant's storage yard.

### Water Treatment and Discharge

Water removed from the two onsite ponds and collected by the groundwater extraction system will be treated on site prior to its discharge off site. The treated water will be released into the natural drainage system approximately 3,000 ft. southeast of the site which eventually drains into the watershed containing the Berlin Reservoir. The treatment system, proposed and described in Section 4.4, will consist of physical treatment, including precipitation, flocculation, coagulation, oil-water separation (groundwater only), filtration, and carbon adsorption. The effluent levels attained by this system will satisfy the requirements of ARARs listed in Chapter 6.

### Operation and Maintenance

Operation of the groundwater extraction and water treatment systems would be automated, but would require weekly inspections. Additionally, the treatment systems would need periodic replenishment of treatment chemicals such as activated carbon, filtration media, and flocculent.

### ALTERNATIVE 4 - ONSITE RCRA LANDFILL FOR VADOSE SOIL

The major components of Alternative 4 include:

- o Access/Deed Restrictions
- o Runoff Monitoring
- o Groundwater Monitoring
- o Removal of Structures
- o Excavation and Incineration of Buried Drums and Tanks
- o Excavation of All Contaminated Vadose Soil and Sediments
- o Multi-Layer Cap

- o Onsite RCRA Landfill for Vadose Materials
- o Vertical Barrier and Groundwater Extraction Wells
- o Elimination of Onsite Surface Water
- o Water Treatment
- o Relocation of Watson Residence

These are primarily the same components as contained in Alternative 3, except that contaminated onsite soil within the vadose zone and contaminated sediments will be overexcavated and placed into a RCRA landfill constructed on site. This alternative provides additional protection over Alternative 3 since it reduces the risk of future leaching of contaminants from the unsaturated materials into the groundwater. The construction and placement of vadose materials and sediments in this landfill should greatly reduce the amount of contaminants migrating downward into the groundwater since the cap reduces the infiltration into these materials and the double liner system collects contamination from the unsaturated soils. As the waste being placed in the landfill would be non-decomposing unsaturated soil, leachate production is assumed to be negligible. As with Alternative 3, site fencing, deed restrictions, and monitoring will be necessary since contaminants remain on site. Remedial goals for all operable units are addressed. The site plan and cross-section for Alternative 4 are shown on Figure 5-5 and 5-6, respectively. It is estimated that it would take approximately 2 to 3 years to implement this alternative.

#### Excavation of Contaminated Vadose Soil and RCRA Landfill Construction

The contaminated materials within the vadose zone (approximately 105,000 cu. yds.) will be overexcavated in stages to allow construction of a double liner system that forms the base of a RCRA landfill. The contaminated sediments in the site ditches and the first impoundment (approximately 1500 cu. yds.) will be excavated and placed within this landfill also. This double liner will include both leachate collection and leachate detection zones, as shown on Figure 5-7. Groundwater recovery well casings passing through the liner system will be sealed to the synthetic membrane liners by either thermal welding or construction of an encapsulating "boot" which would be sealed to the synthetic membrane. The contaminated materials will be placed within this liner and will be covered with a multi-layer cap. This RCRA landfill will be similar to the multi-layer cap in reducing the risk of contacts with contaminated materials, and also further reduces the risk of contaminants migrating vertically downward into the groundwater. Water collected by the double liner system (estimated to be less than 100 gallons/day) will be processed by the onsite treatment system and discharged off site.

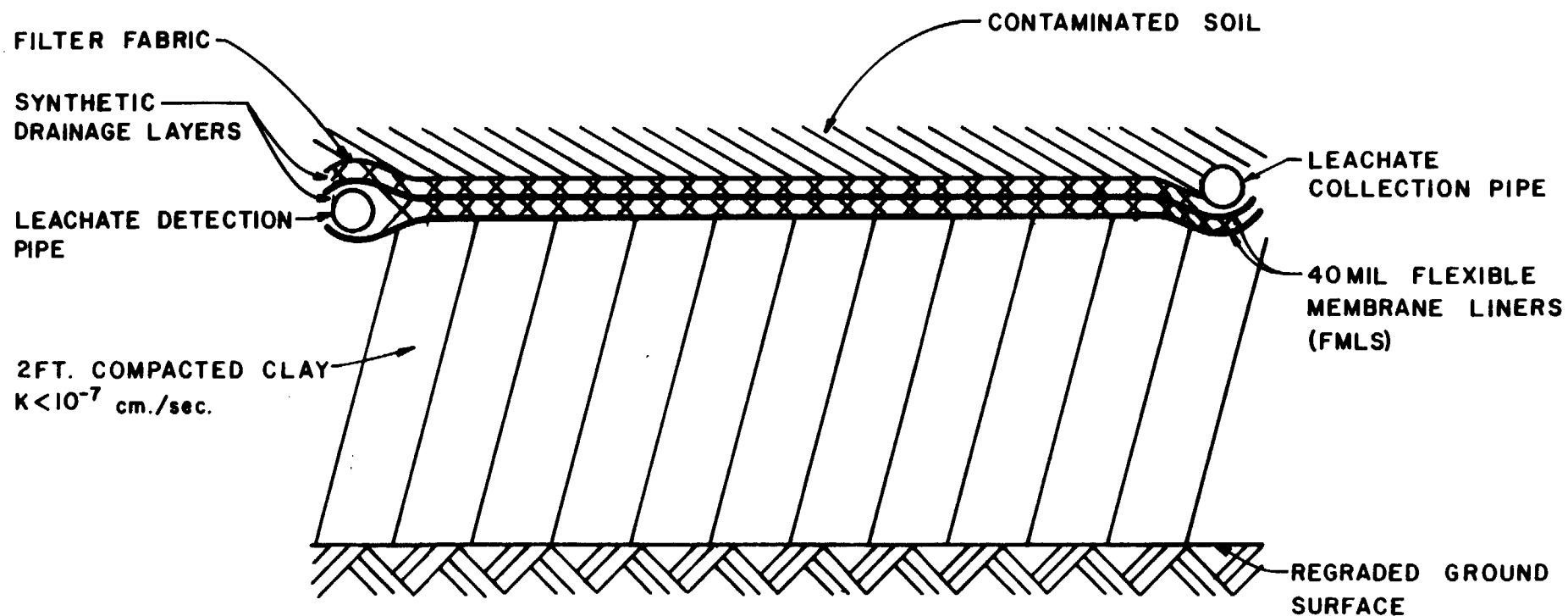
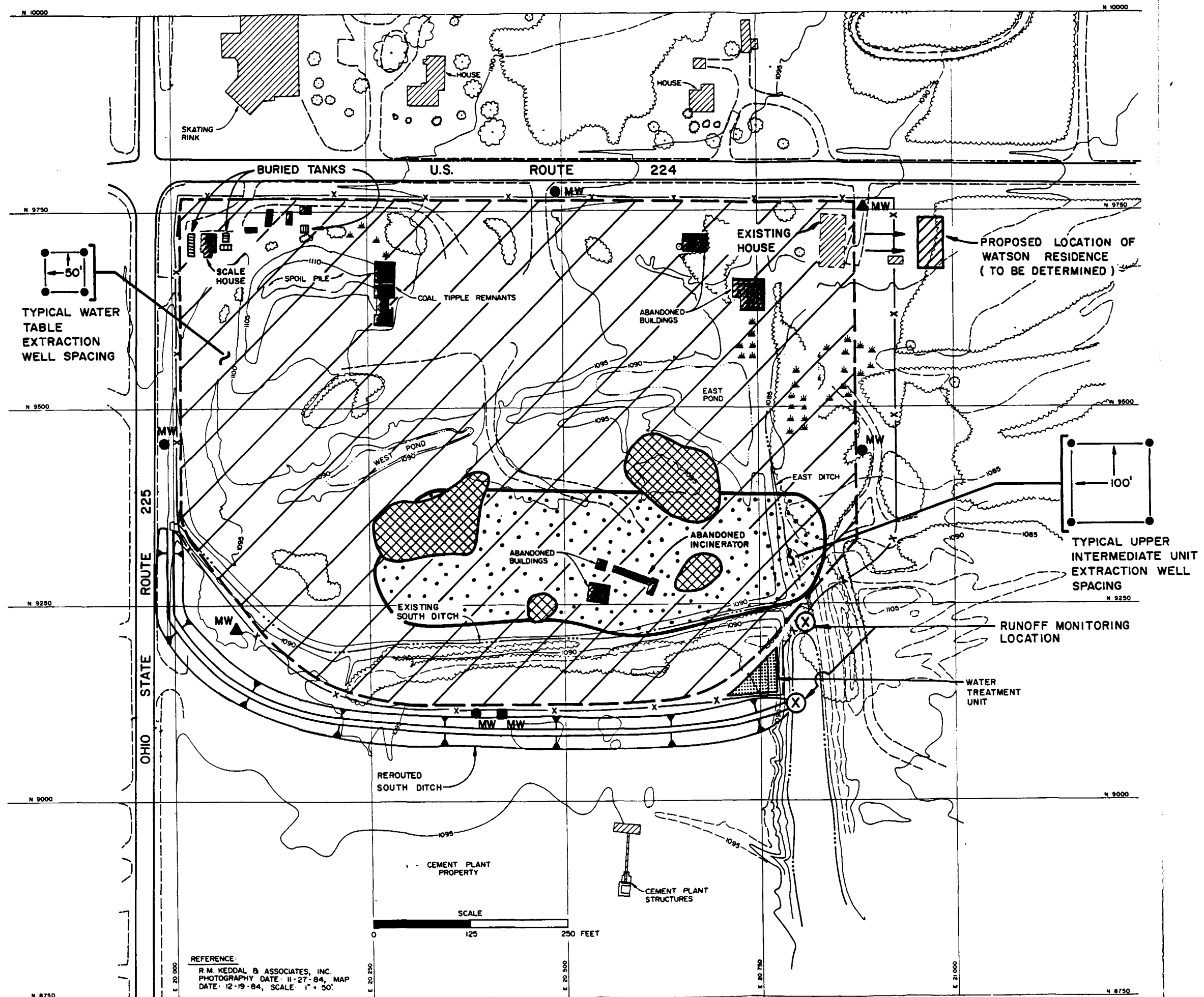


FIGURE 5 - 7  
TYPICAL RCRA LANDFILL  
LINER  
SUMMIT NATIONAL FS



**LEGEND**

/// AREA OF MULTI-LAYER CAP/RCRA LANDFILL/ WATER TABLE EXTRACTION WELLS ON 50' GRID

--- SLURRY WALL

X---X SITE FENCE DELINEATING AREA OF DEED RESTRICTIONS

■ ONSITE STRUCTURES REMOVAL

(X) RUNOFF MONITORING LOCATION

MW WATER TABLE MONITORING WELL

■ MW INTERMEDIATE UNIT MONITORING WELL

▲ MW UPPER SHARON AQUIFER MONITORING WELL

⊞ POTENTIAL AREAS OF BURIED DRUMS

⊞ ESTIMATED AREA OF CONTAMINATED GROUNDWATER IN UPPER INTERMEDIATE UNIT/UPPER INTERMEDIATE UNIT EXTRACTION WELLS ON 100' GRID

0 125 250  
SCALE IN FEET APPROXIMATE

FIGURE 5 - 5  
 ALTERNATIVE 4  
 ONSITE RCRA LANDFILL  
 SITE PLAN  
 SUMMIT NATIONAL FS



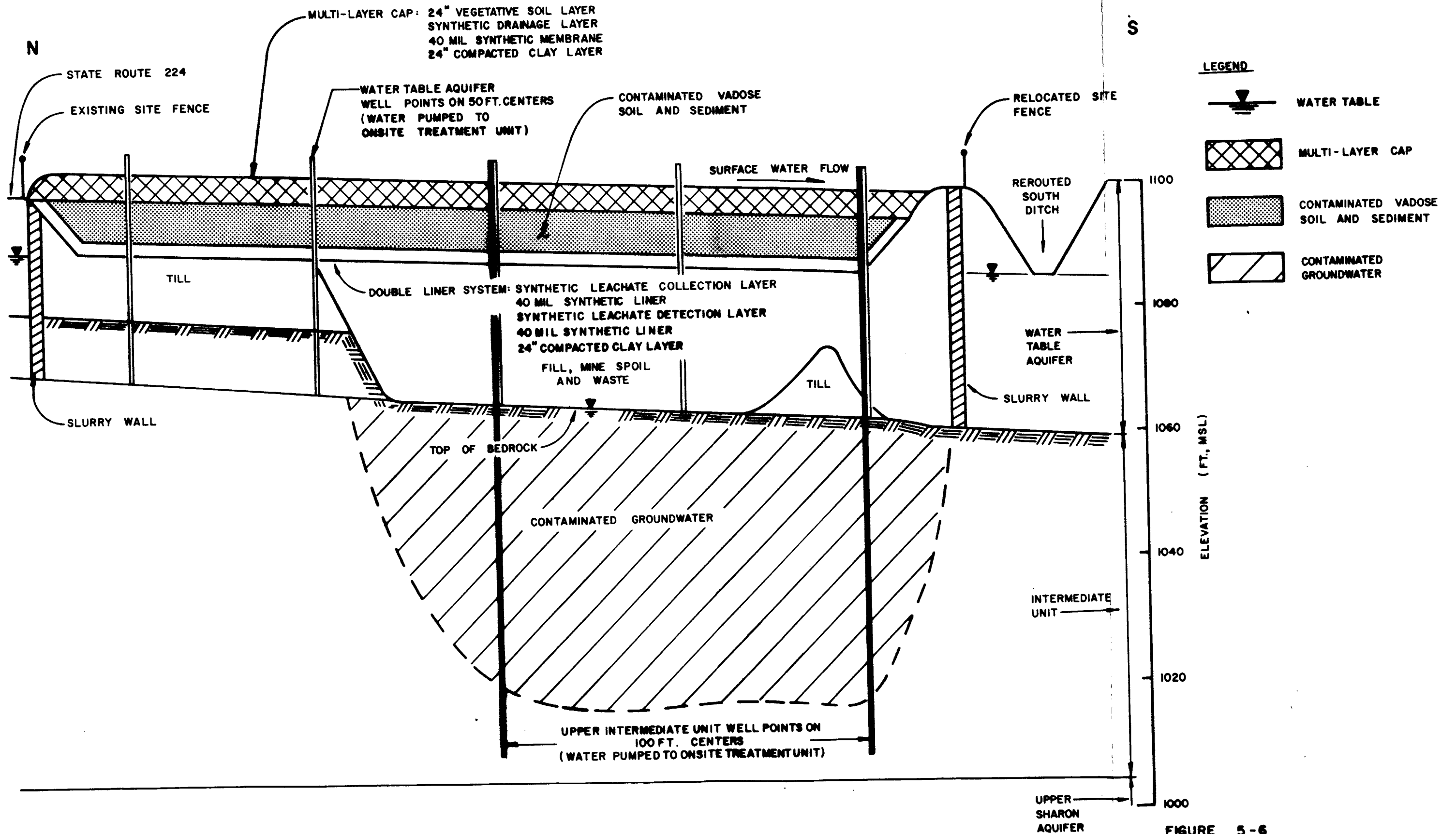


FIGURE 5-6  
 ALTERNATIVE 4 - ONSITE RCRA LANDFILL  
 GENERALIZED NORTH - SOUTH  
 CROSS SECTION  
 SUMMIT NATIONAL FS

### Operation and Maintenance

The operation and maintenance requirements will be greater for Alternative 4 than for Alternative 3 due to the leachate collection and detection zones and appurtenances. The cap will require the same O & M as Alternative 3. Additionally, the liner system will require O & M to assure that the collection and detection zones remain operational. Monitoring will be performed as discussed with Alternative 3 since contaminated materials will remain on site.

### ALTERNATIVE 5 - THERMAL TREATMENT OF "HOT SPOT" SOIL

The major components of Alternative 5 are:

- o Access/Deed Restrictions
- o Runoff Monitoring
- o Groundwater Monitoring
- o Removal of Structures
- o Excavation and Incineration of Drums and Tanks, "Hot Spot" Soil, and Sediments
- o Soil Replacement for Ash in Onsite RCRA Landfill
- o Multi-Layer Cap
- o Vertical Barrier and Groundwater Extraction Wells
- o Elimination of Onsite Surface Water
- o Water Treatment
- o Relocation of Watson Residence

This alternative consists of the same components as Alternative 3, with the additional excavation and thermal treatment of approximately 27,000 cu. yds. of highly contaminated soil from the southern portion of the site. A number of soil removal scenarios were developed and evaluated to present a range of protectiveness. The selection of "hot spot" soils were based on historical and RI sampling data, health risk associated with the chemicals detected in the onsite soils, and the residual cancer risk for any soil cells not included in the "hot spot" removal. Details of the "hot spot" soils evaluation are presented in Appendix A. Drum and tank contents incineration would be performed in conjunction with soil and contaminated sediment incineration. This alternative would eliminate major known existing onsite sources of contamination and greatly reduce the volume and toxicity of contaminated soil. Risks associated with contact with soil contaminants would be reduced by the installation of the multi-layer cap. The removal of drums and the treatment of the most highly contaminated soil would reduce the potential for

contaminant release or leaching to groundwater. Risks associated with the leaching of residual contamination to groundwater are greatly reduced by the underlying RCRA liner system. A plan view and cross-section of the site showing proposed modifications associated with this alternative are presented on Figures 5-8 and 5-9, respectively. It is estimated that implementation of this alternative will require 5 years.

#### Excavation and Onsite Incineration, and Onsite Replacement of Buried Drums and Tanks and "Hot Spot" Soil

In addition to excavation of the buried drums and tanks described for Alternative 3, a large portion of the most highly contaminated soil on site will also be excavated along with contaminated sediments. Excavated soil, sediment, drums and tanks would be thermally treated on site in a mobile rotary kiln incinerator in order to effectively destroy all organic contaminants. The incineration of all drummed materials would require 1.5 years and soil and sediment incineration would require 4 years.

#### Onsite Soil Replacement

The treatment residue (treated material after incineration consisting primarily of sterilized soil with inorganic contaminants and debris from structure demolition) will be used to backfill the excavation and the entire site will be capped, as described for Alternative 3. A double liner satisfying the requirements of RCRA will be installed to contain the treatment residue. Construction of the liner was described for Alternative 4.

#### Operation and Maintenance

During the thermal treatment phase, the incinerator would be operated 16 hours per day, seven days per week, and would require routine maintenance. After treatment and capping, required operation and maintenance activities would be ongoing monitoring and cap maintenance, and liner system O & M as previously described for Alternatives 3 and 4.

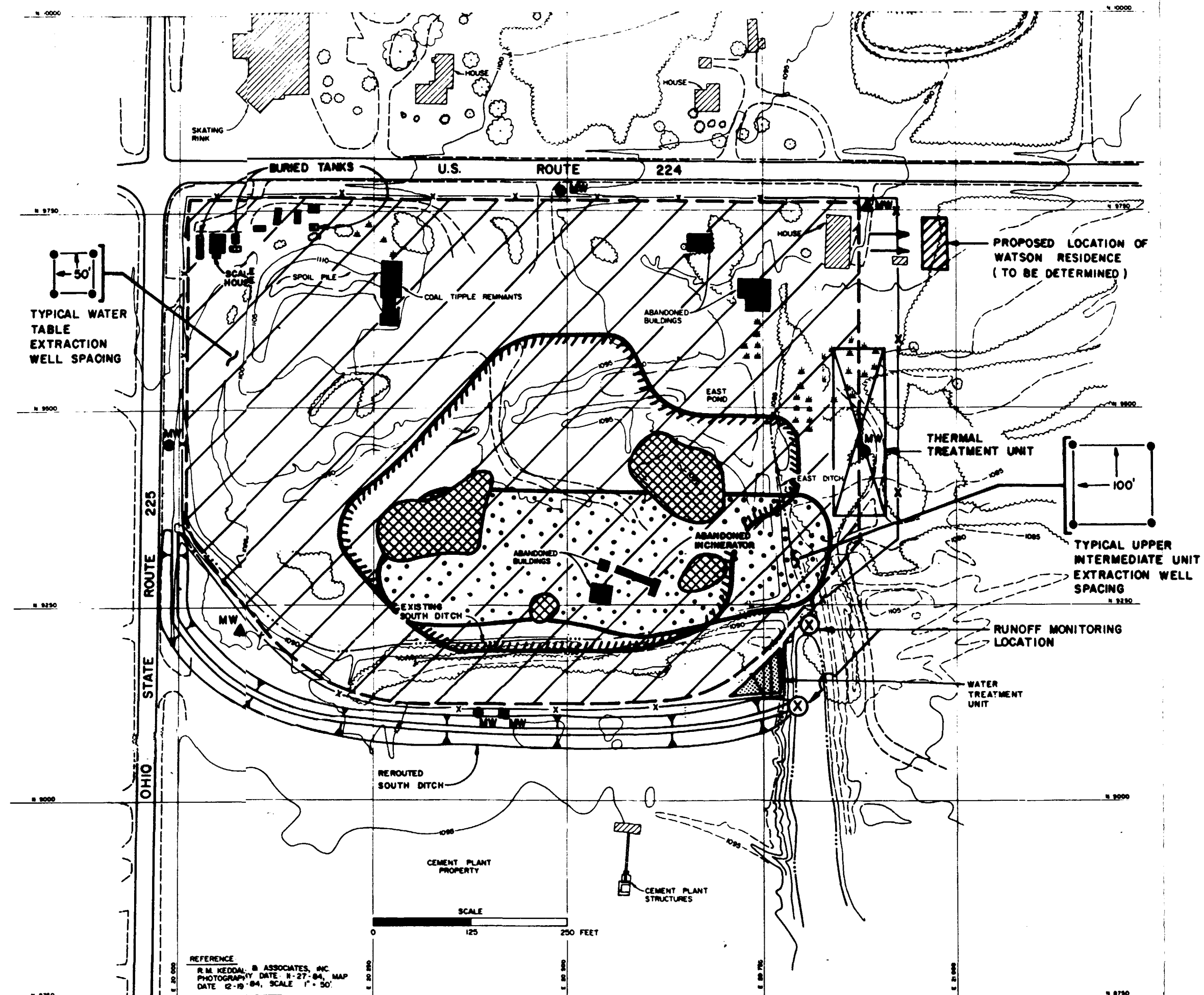


FIGURE 5-8  
 ALTERNATIVE 5  
 THERMAL TREATMENT  
 OF "HOT SPOT" SOIL  
 SITE PLAN  
 SUMMIT NATIONAL FS

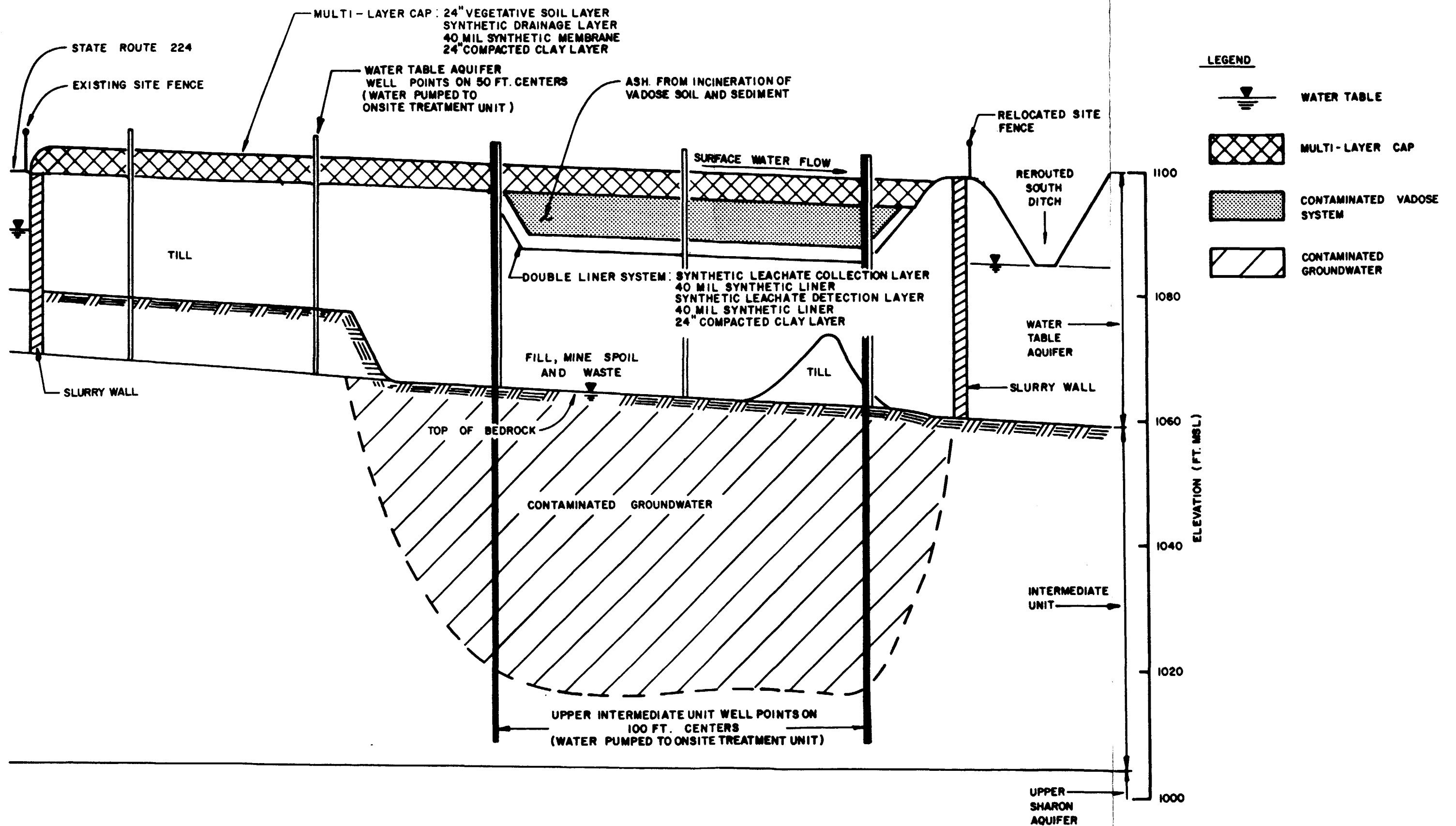


FIGURE 5-9  
ALTERNATIVE 5 - THERMAL  
TREATMENT OF "HOT SPOT" SOIL  
GENERALIZED NORTH - SOUTH  
CROSS SECTION  
SUMMIT NATIONAL FS

#### ALTERNATIVE 6 - THERMAL TREATMENT OF VADOSE SOIL

The major components of Alternative 6 are:

- o Access/Deed Restrictions
- o Runoff Monitoring
- o Groundwater Monitoring
- o Removal of Structures
- o Excavation and Incineration of Buried Drums and Tanks, All Contaminated Vadose Soil and Sediments
- o Soil Replacement for Ash in Onsite RCRA Landfill
- o Multi-Layer Cap
- o Vertical Barrier and Groundwater Extraction Wells
- o Elimination of Onsite Surface Water
- o Water Treatment
- o Relocation of Watson Residence

This alternative includes the same components as Alternative 5, except that instead of treating only "hot spot" soil, all vadose soil determined to be contaminated, based on RI soil boring data, would be excavated and incinerated. A total of approximately 105,000 cu. yds. of soil would be excavated, incinerated on site, and back-filled in the same manner as described in Alternative 5. Two incineration units would be employed on site and the duration of treatment would be approximately 9 years. This alternative addressed remedial goals for all operable units. Greater protection of public health and environment would be achieved at completion of this action than that achieved by Alternative 5 since a greater amount of contaminated material would be destroyed. Operation and maintenance would be about the same as for Alternative 5. A plan view and cross-section for this alternative are presented on Figures 5-10 and 5-11, respectively. It is estimated that about 9 years would be required to implement this alternative using two thermal treatment units.

#### ALTERNATIVE 7 - THERMAL TREATMENT OF ALL UNCONSOLIDATED MATERIAL TO BEDROCK

The major components of Alternative 8 are:

- o Access/Deed Restriction
- o Runoff Monitoring
- o Groundwater Monitoring
- o Removal of Onsite Structure
- o Excavation and Incineration of Buried Drums and Tanks
- o Excavation and Thermal Treatment of All Contaminated Onsite Materials

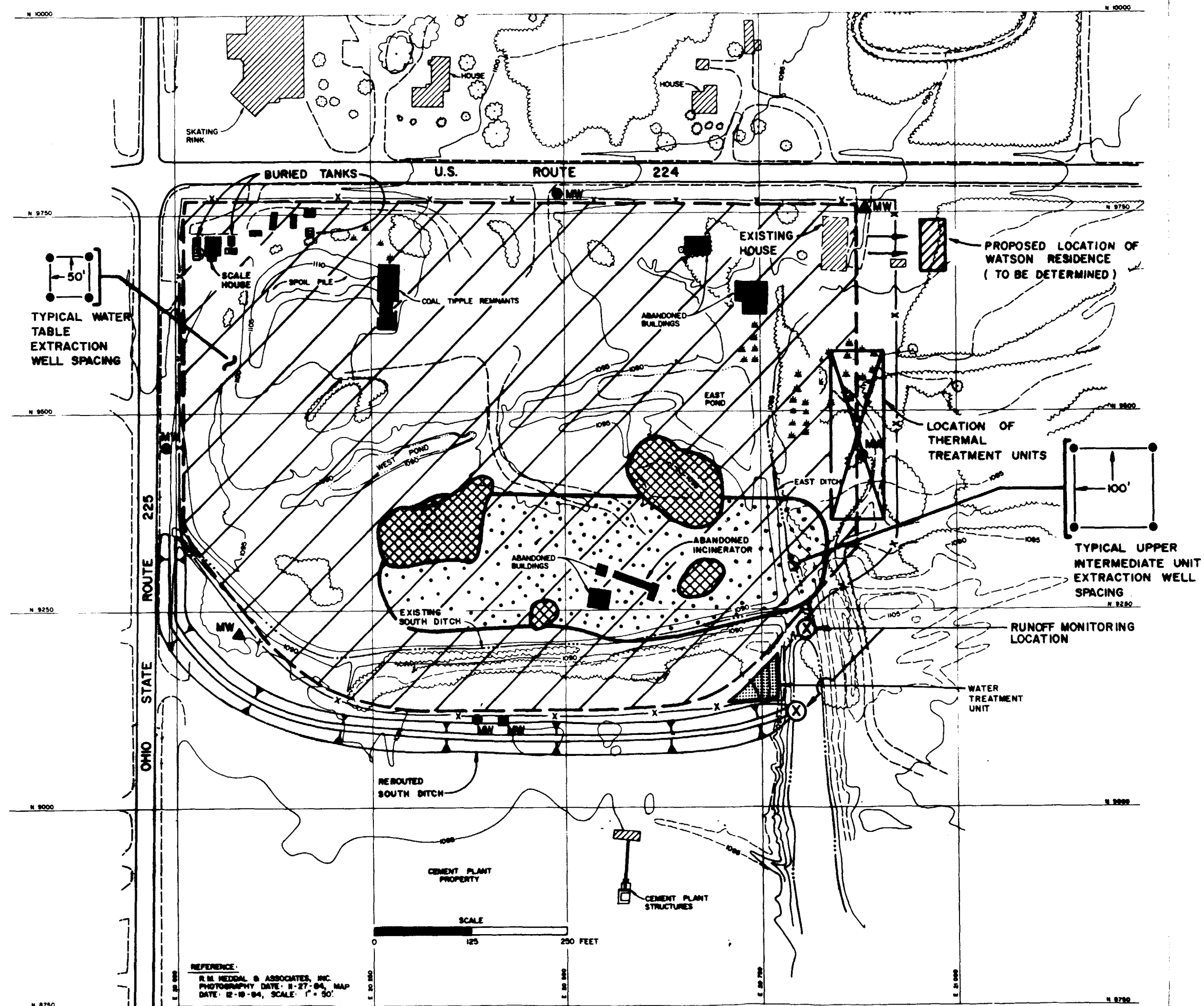
- o Soil Replacement for Treatment Residue in Onsite RCRA Landfill
- o Multi-Layer Cap
- o Vertical Barrier and Groundwater Extraction Drains in Water Table Aquifer
- o Groundwater Extraction Wells In Upper Intermediate Unit
- o Elimination of Onsite Surface Water
- o Water Treatment
- o Relocation of Watson Residence

The plan of this alternative is shown on Figure 5-12, while the cross-section is shown on Figure 5-13. It is estimated that between 25 and 26 years will be required to implement this alternative.

In this alternative, all contaminated, unconsolidated material, including buried tanks and drums, all contaminated vadose soil, and all saturated unconsolidated material associated with the contaminated portion of the Water Table Aquifer would be excavated and treated. Excavation would be performed in stages using conventional earthmoving equipment such as draglines and bulldozers. Material excavated from below the water level would be allowed to dewater on drying beds prior to onsite thermal treatment. These materials will require dewatering since greater than 75% of the materials will be obtained from below onsite groundwater level. In addition, seepage into the open excavation (estimated to be 6,000 gallons per day) would have to be pumped and treated at the onsite treatment plant prior to offsite discharge.

As described in the previous alternatives, contents of buried drums and tanks would also be thermally treated on site. Contaminated soil and other unconsolidated material amounting to approximately 430,000 cu. yds., would be treated on site using the thermal treatment system described in Section 4. Treatment of this material and implementation of the alternative is estimated to require about 12 years using two incinerator units.

The excavation would be backfilled to about 5 ft. below the original ground surface to get above the groundwater level using clean earthfill, at which point a RCRA double liner would be constructed. After treatment, the treated material would be backfilled on site in a RCRA landfill, which would be constructed in stages.



# **LEGEND**

- AREA OF MULTI-LAYER CAP/WATER TABLE EXTRACTION WELLS ON 50' GRID
- SLURRY WALL
- SITE FENCE DELINEATING AREA OF DEED RESTRICTIONS
- ONSITE STRUCTURES REMOVAL
- RUNOFF MONITORING LOCATION
- WATER TABLE MONITORING WELL
- INTERMEDIATE UNIT MONITORING WELL
- UPPER SHARON AQUIFER MONITORING WELL
- POTENTIAL AREAS OF BURIED DRUMS
- ESTIMATED AREA OF CONTAMINATED GROUNDWATER IN UPPER INTERMEDIATE UNIT/UPPER INTERMEDIATE UNIT EXTRACTION WELLS ON 100' GRID



SCALE IN FEET  
APPROXIMATE

**FIGURE 5-10  
ALTERNATIVE 6  
THERMAL TREATMENT  
OF VADOSE ZONE MATERIALS  
SITE PLAN  
SUMMIT NATIONAL FS**



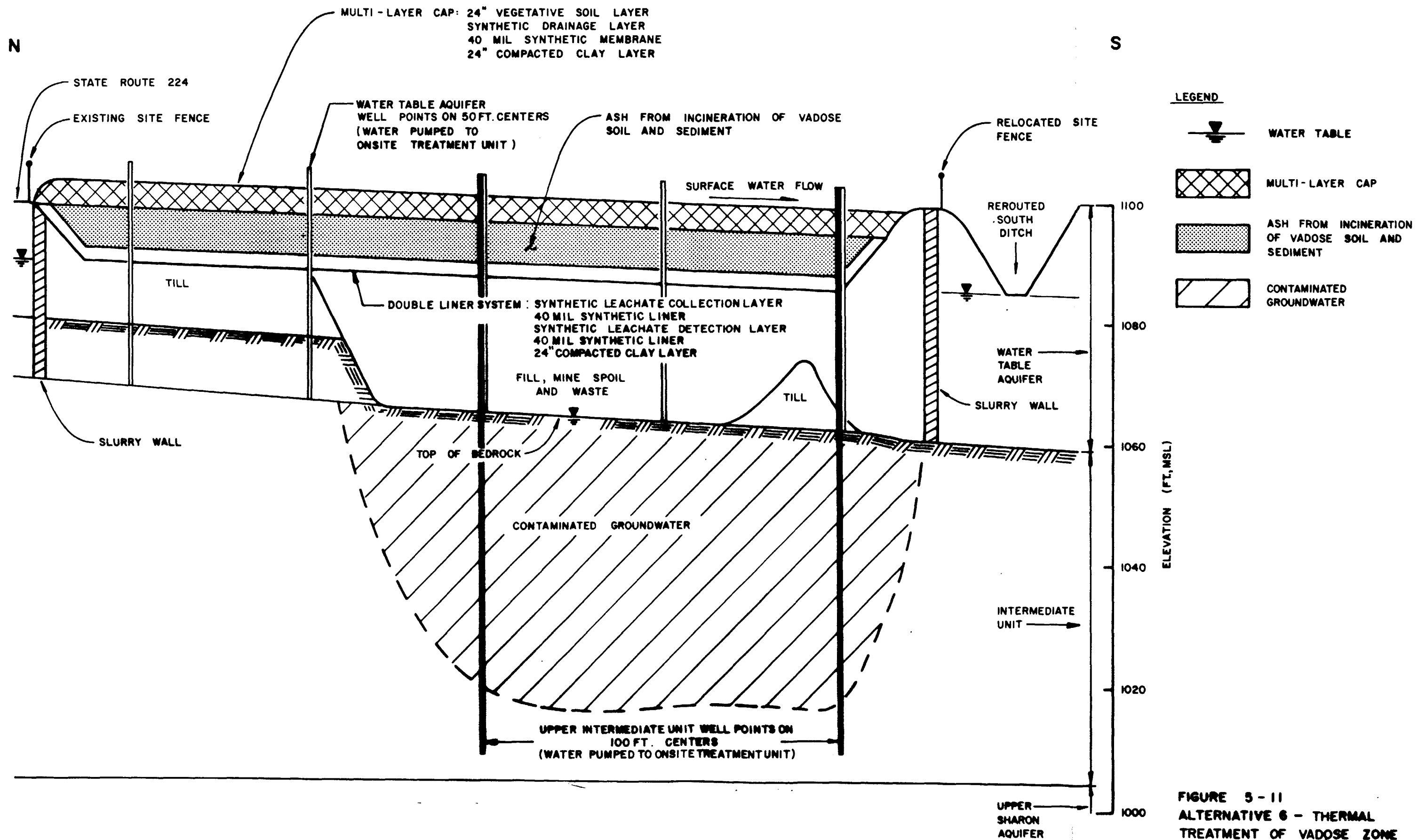


FIGURE 5-11  
ALTERNATIVE 6 - THERMAL  
TREATMENT OF VADOSE ZONE  
MATERIALS  
GENERALIZED NORTH - SOUTH  
CROSS SECTION  
SUMMIT NATIONAL FS

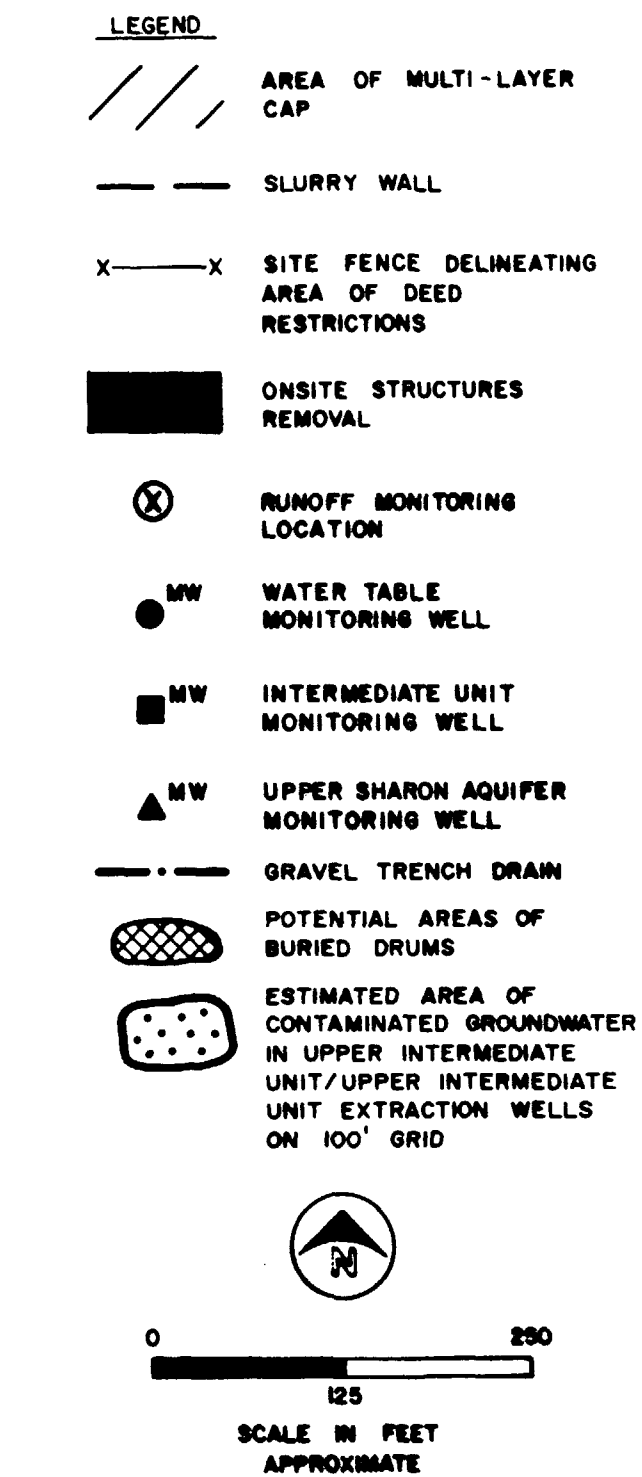
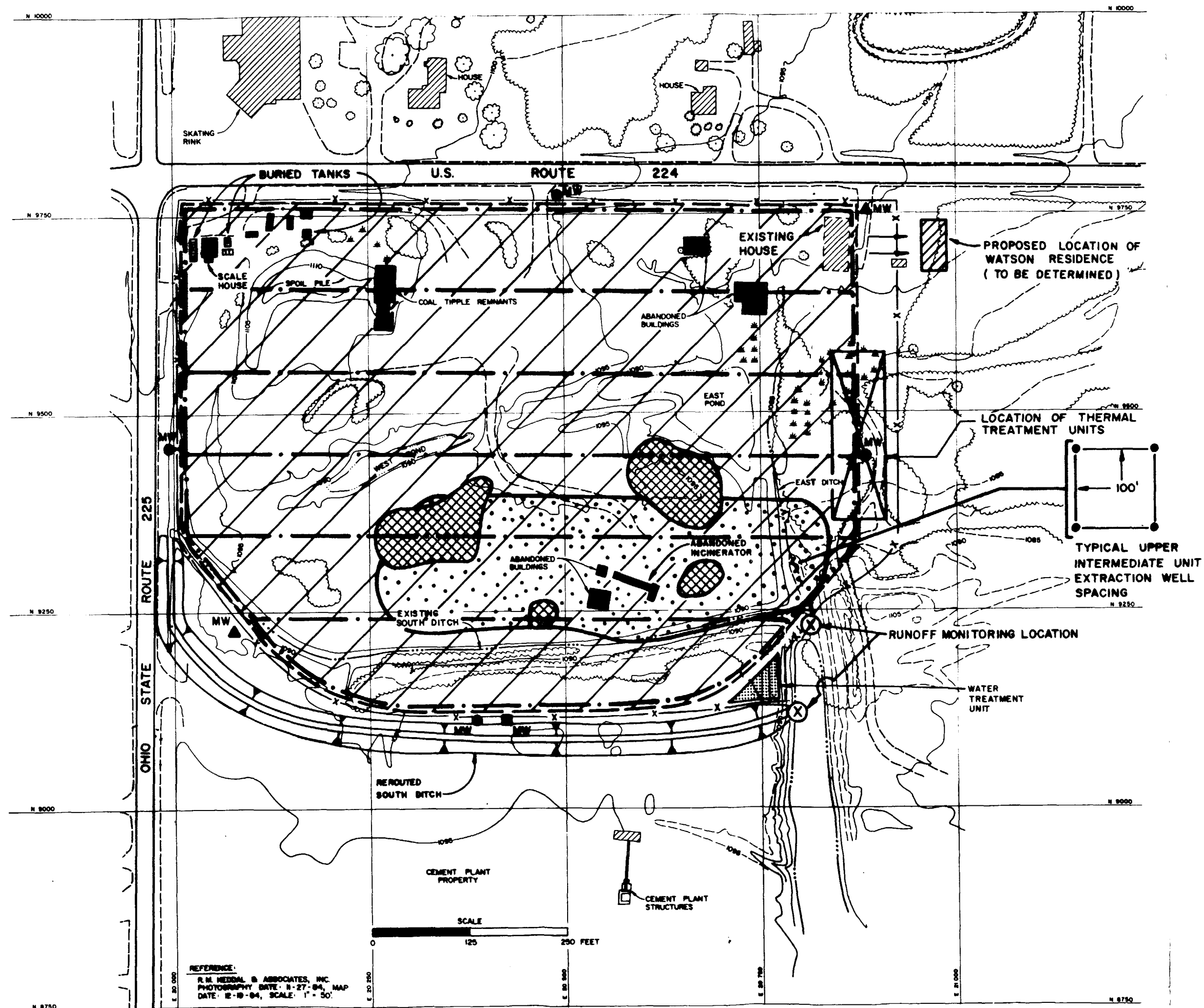


FIGURE 5-12  
ALTERNATIVE 7  
THERMAL TREATMENT  
OF ALL UNCONSOLIDATED MATERIALS  
SITE PLAN  
SUMMIT NATIONAL FS

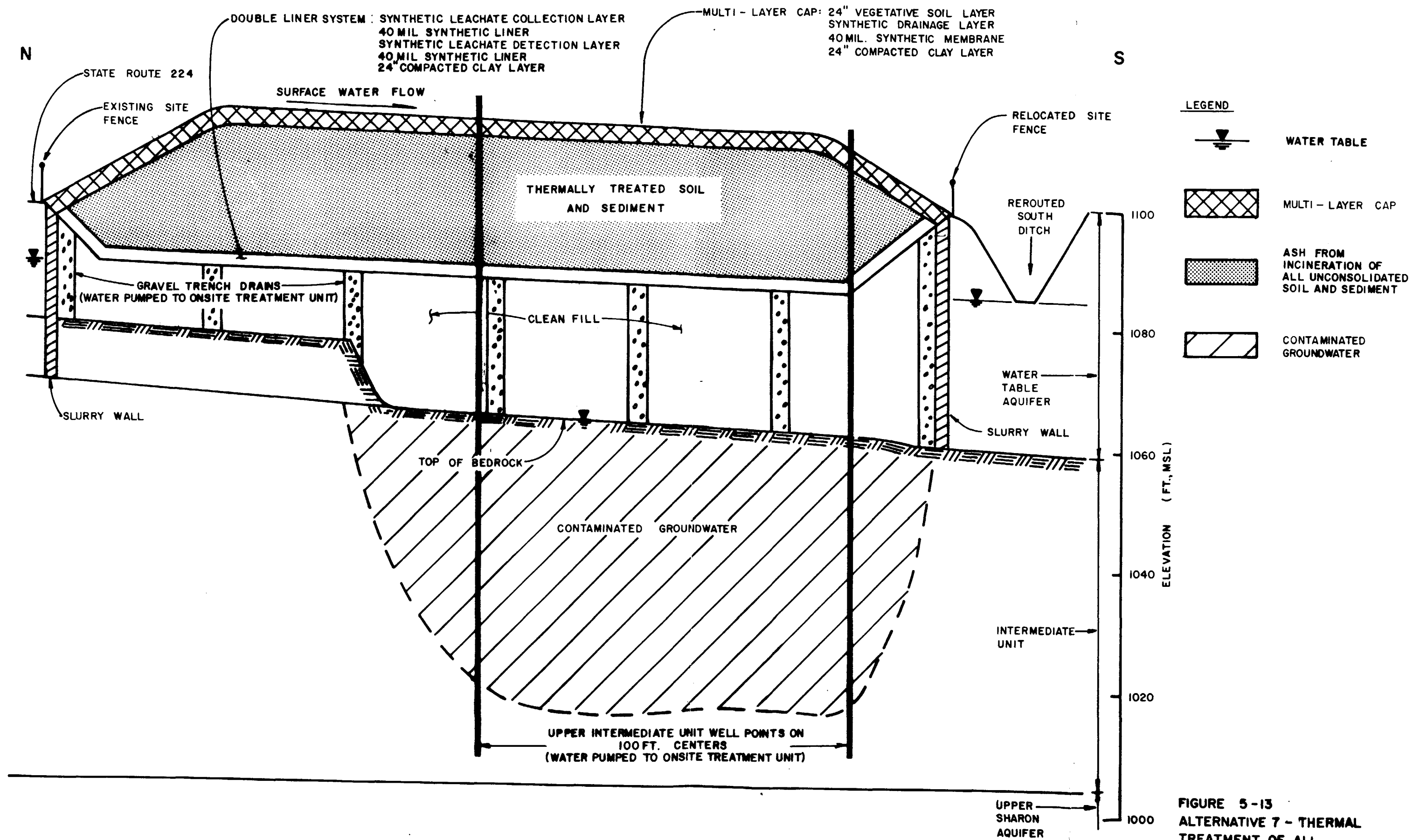


FIGURE 5-13  
ALTERNATIVE 7 - THERMAL  
TREATMENT OF ALL  
UNCONSOLIDATED MATERIALS  
GENERALIZED NORTH - SOUTH  
CROSS SECTION  
SUMMIT NATIONAL FS

Since this alternative would require excavation to bedrock, pipe and media drains would be used for dewatering of the Water Table Aquifer on site. These drains would be constructed during placement of the backfill, thus eliminating the need for shoring of the trench walls during construction. A trench around the site perimeter and trenches inside the perimeter on 100 ft. centers would be required. Free product collection would be performed with groundwater and seepage collection during the excavation phase. Analysis of groundwater removed via the drains would be performed to determine whether this water requires treatment. Treatment will probably not be necessary since all contaminated soil would have been previously removed and treated.

As previously described, contaminated groundwater in the Upper Intermediate Unit would be collected by extraction wells, and treated in the onsite treatment plant prior to discharge.

#### ALTERNATIVE 8 - IN SITU VITRIFICATION OF "HOT SPOT" SOIL

The major components of Alternative 8 are:

- o Access/Road Restrictions
- o Runoff Monitoring
- o Groundwater Monitoring
- o Removal of Structures
- o Elimination of Onsite Surface Water
- o Excavation of Sediment and Placement Under Cap
- o Excavation and Incineration of Drums and Tanks
- o In Situ Vitrification of "Hot Spot" Soil
- o Multi-Layer Cap
- o Vertical Barrier and Groundwater Extraction Wells
- o Water Treatment
- o Relocation of Watson Residence

All components of this alternative, with the exception of in-situ vitrification, have been discussed in detail for previous alternatives. The "hot spot" soil addressed here is the same soil unit as that addressed under Alternative 5 - Thermal Treatment of "Hot Spot" Soil. The soil to be vitrified consists of approximately 27,000 cu. yds. of highly contaminated soil located in the southern portion of the site. This alternative would eliminate major portions of known existing onsite sources of contamination, and greatly reduce the toxicity and mobility of soil contaminants. The removal of the drums and tanks for subsequent offsite thermal treatment and the in-situ

vittrification of a large portion of the most highly contaminated soil would reduce the potential for contaminant release or leaching to groundwater. Contaminated soil outside the limits of the "hot spot" vittrification and contaminated sediments would be covered with a multi-layer cap as described for previous alternatives. The cap would reduce future risks of direct contact with contaminated materials and contaminant migration. A plan view and cross-section of the site showing proposed modifications associated with this alternative are presented on Figures 5-14 and 5-15, respectively. It is estimated that about 2 years will be required to implement this alternative.

Onsite buried drums would have to be removed prior to vittrification as actual buried drum densities are not known and are potentially greater than the allowable process parameters for ISV treatment. Buried tanks would also be removed as they tie outside the bounds of the "hot spot" treatment zone.

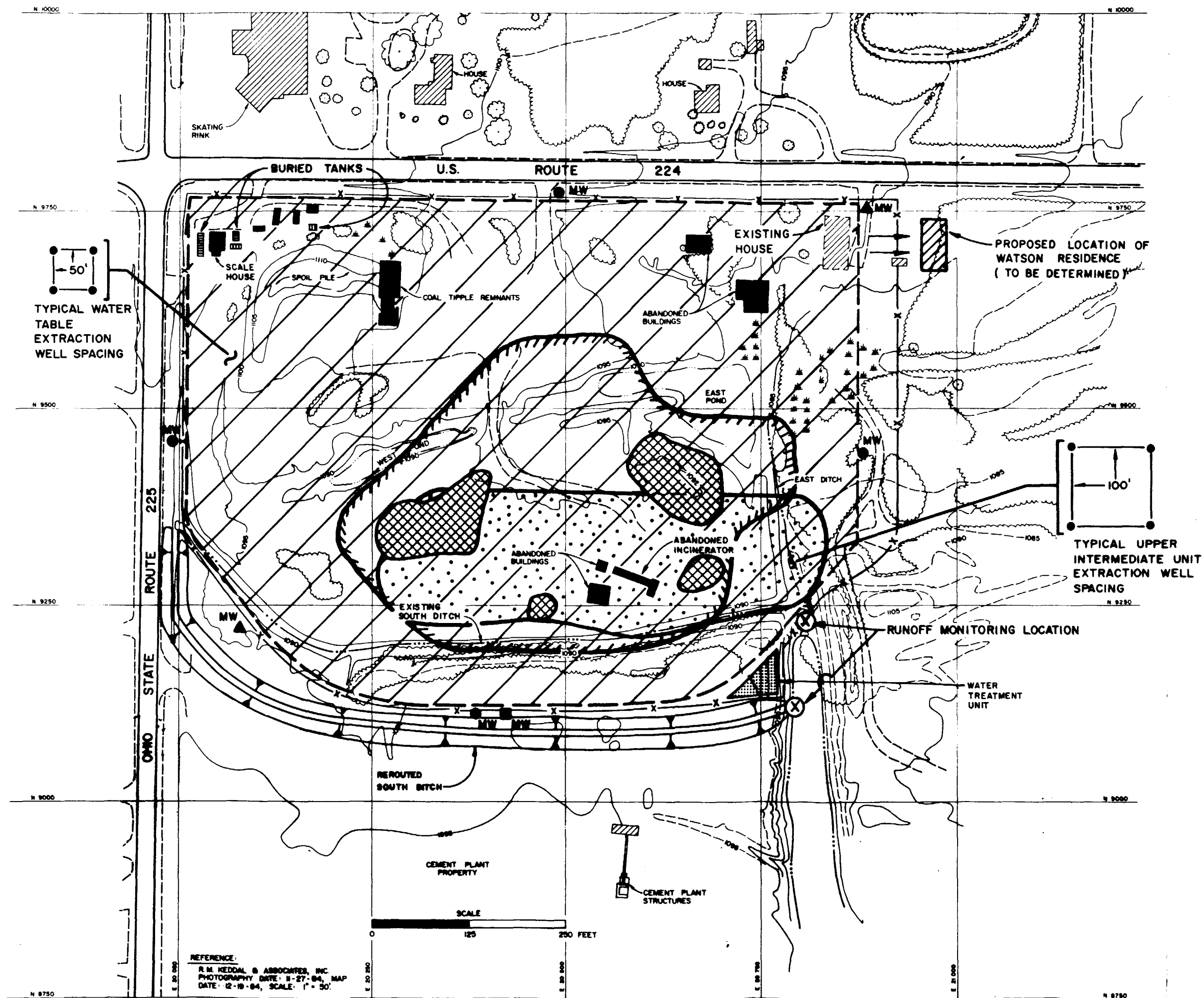
Vitrification of the "hot spot" soil provides a more reliable means of containing inorganic contaminants than placement in a double liner system as there is little risk of system failure resulting in contaminant release. Short term health risks area also minimized since contaminated soil is not excavated prior to treatment, as it is treated in place.

The vittrified soil mass would require no additional maintenance, while the cap would require ongoing maintenance similar to that described in Alternatives 3-7. Other operation and maintenance activities, such as continued groundwater extraction and treatment and monitoring activities, would be similar to those in Alternative 5.












#### ALTERNATIVE 9 - IN SITU VITRIFICATION OF VADOSE SOIL

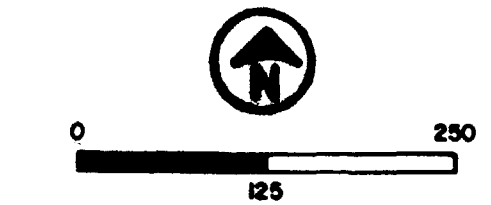
The major components of Alternative 9 are:

- o Access/Deed Restrictions
- o Runoff Monitoring
- o Groundwater Monitoring
- o Removal of Structures
- o Excavation and Incineration of Buried Drums and Tanks
- o In-Situ Vitrification of All Contaminated Vadose Soils and Sediments
- o Soil Cover Over Vitrified Mass
- o Vertical Barrier and Groundwater Extraction Wells
- o Elimination of Onsite Surface Water
- o Water Treatment
- o Relocation of Watson Residence



**LEGEND**

-  AREA OF MULTI-LAYER CAP/WATER TABLE EXTRACTION WELLS ON 50' GRID
-  SLURRY WALL
-  SITE FENCE DELINEATING AREA OF DEED RESTRICTIONS
-  ONSITE STRUCTURES REMOVAL
-  RUNOFF MONITORING LOCATION
-  MW WATER TABLE MONITORING WELL
-  MW INTERMEDIATE UNIT MONITORING WELL
-  MW UPPER SHARON AQUIFER MONITORING WELL
-  APPROXIMATE LIMITS OF VITRIFIED "HOT SPOT" SOIL
-  POTENTIAL AREAS OF BURIED DRUMS
-  ESTIMATED AREA OF CONTAMINATED GROUNDWATER IN UPPER INTERMEDIATE UNIT/UPPER INTERMEDIATE UNIT EXTRACTION WELLS ON 100' GRID



SCALE IN FEET  
APPROXIMATE  
**FIGURE 5-14**  
**ALTERNATIVE 8**  
**IN SITU VITRIFICATION**  
**OF "HOT SPOT" SOIL**  
**SITE PLAN**  
**SUMMIT NATIONAL FS**

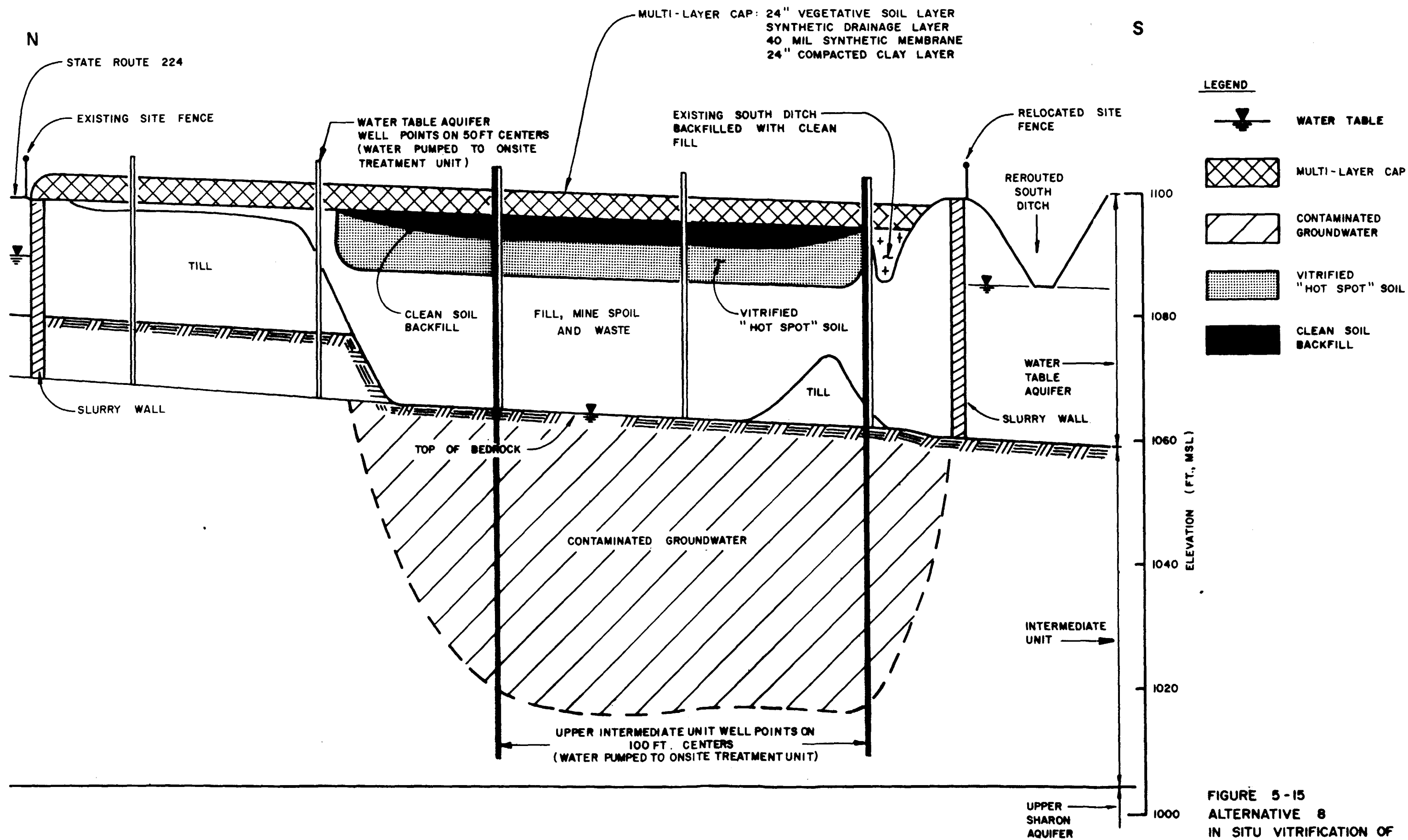
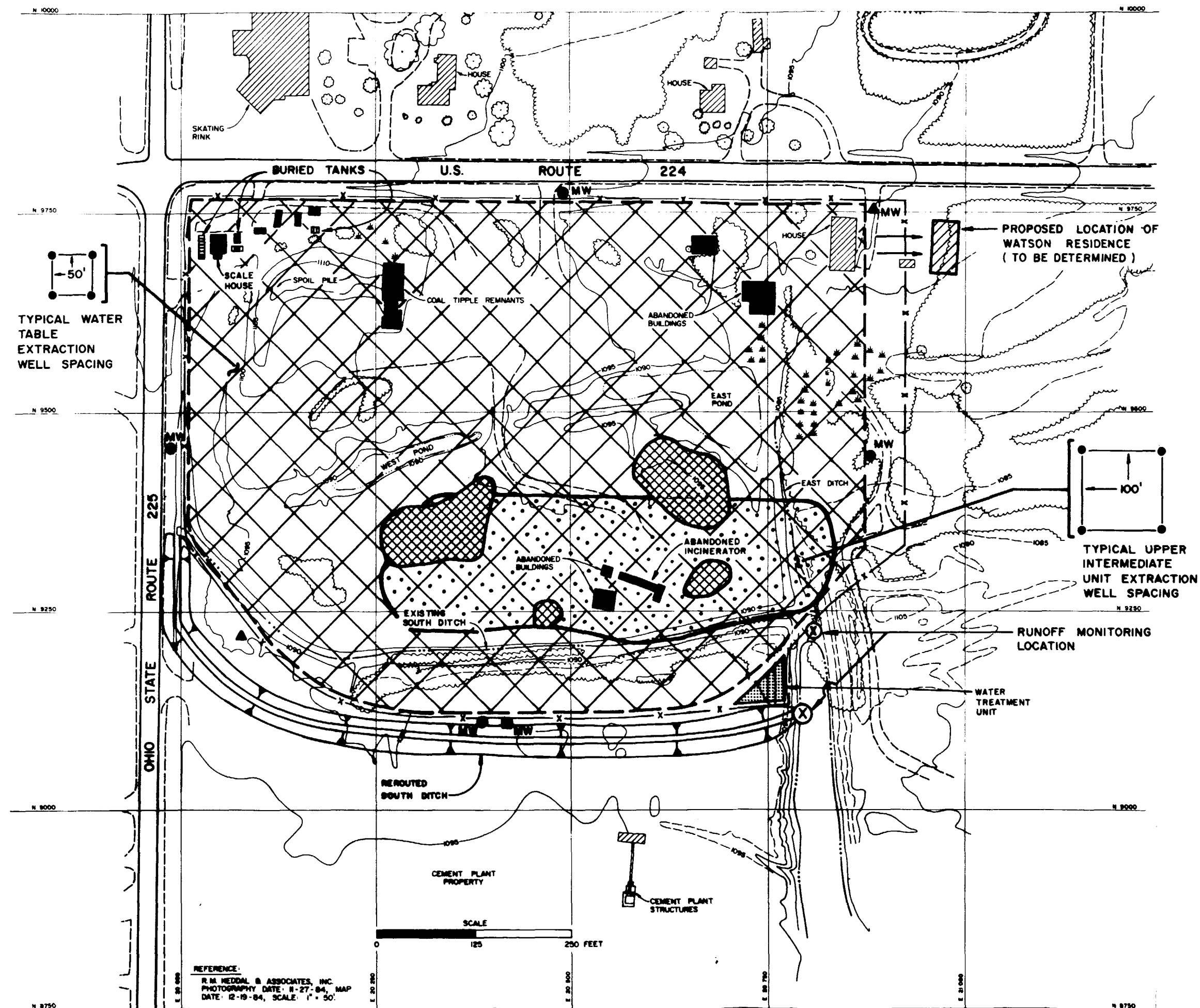


FIGURE 5-15  
ALTERNATIVE 8  
IN SITU VITRIFICATION OF  
"HOT SPOT" SOIL  
GENERALIZED NORTH-SOUTH  
CROSS SECTION  
SUMMIT NATIONAL FS











Alternative 9 employs the same basic components as Alternative 8, except that instead of vitrifying only the "hot spot" soil, all contaminated vadose soil (approximately 105,000 cu. yds.) and contaminated sediments (approximately 1500 cu. yds.) would be vitrified. The buried drums and tanks would be removed and incinerated off site, thus eliminating a major known existing onsite contaminant source. All contaminated vadose soil ranging in depth from 2 ft. to 8 ft., as determined by RI soil boring data, would be treated by in-situ vitrification (ISV), thereby destroying organic soil contaminants while encapsulating inorganic contaminants in the resulting vitrified mass. Prior to vitrification, the site would be graded to allow for a relatively smooth surface after vitrification. The subsided ground surface would be backfilled to original grade with clean earthfill and then covered with a 12 in. thick topsoil layer which would then be vegetated. Short-term health risks during construction would be minimal compared with alternatives in which contaminated soil would be excavated prior to treatment, as the soil is treated in-place. Figures 5-16 and 5-17 present a plan view and cross-section, respectively, which show the incorporation of this alternative in schematic form. The implementation of this alternative will require about 6 years.

Ongoing maintenance associated with this alternative would consist of groundwater extraction and treatment, monitoring of groundwater and runoff, and maintenance of the vegetative layer. There would be no long-term maintenance required for the vitrified soil mass, and there would be very little risk of future release of inorganic contaminants caused by containment system failure, as inorganic contaminants are encapsulated within the vitrified mass.





# LEGEND

-  AREA OF VITRIFIED VADOSE SOIL AND TOPSOIL COVER/ WATER TABLE EXTRACTION WELLS ON 50' GRID
-  SLURRY WALL
-  SITE FENCE DELINEATING AREA OF DEED RESTRICTIONS
-  ONSITE STRUCTURES REMOVAL
-  RUNOFF MONITORING LOCATION
-  WATER TABLE MONITORING WELL
-  INTERMEDIATE UNIT MONITORING WELL
-  UPPER SHARON AQUIFER MONITORING WELL
-  POTENTIAL AREAS OF BURIED DRUMS
-  ESTIMATED AREA OF CONTAMINATED GROUNDWATER IN UPPER INTERMEDIATE UNIT/UPPER INTERMEDIATE UNIT EXTRACTION WELLS ON 100' GRID

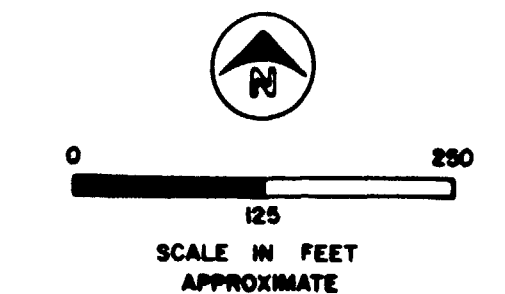


FIGURE 5-16  
ALTERNATIVE 9  
IN SITU VITRIFICATION  
OF VADOSE SOIL  
SITE PLAN  
SUMMIT NATIONAL FS

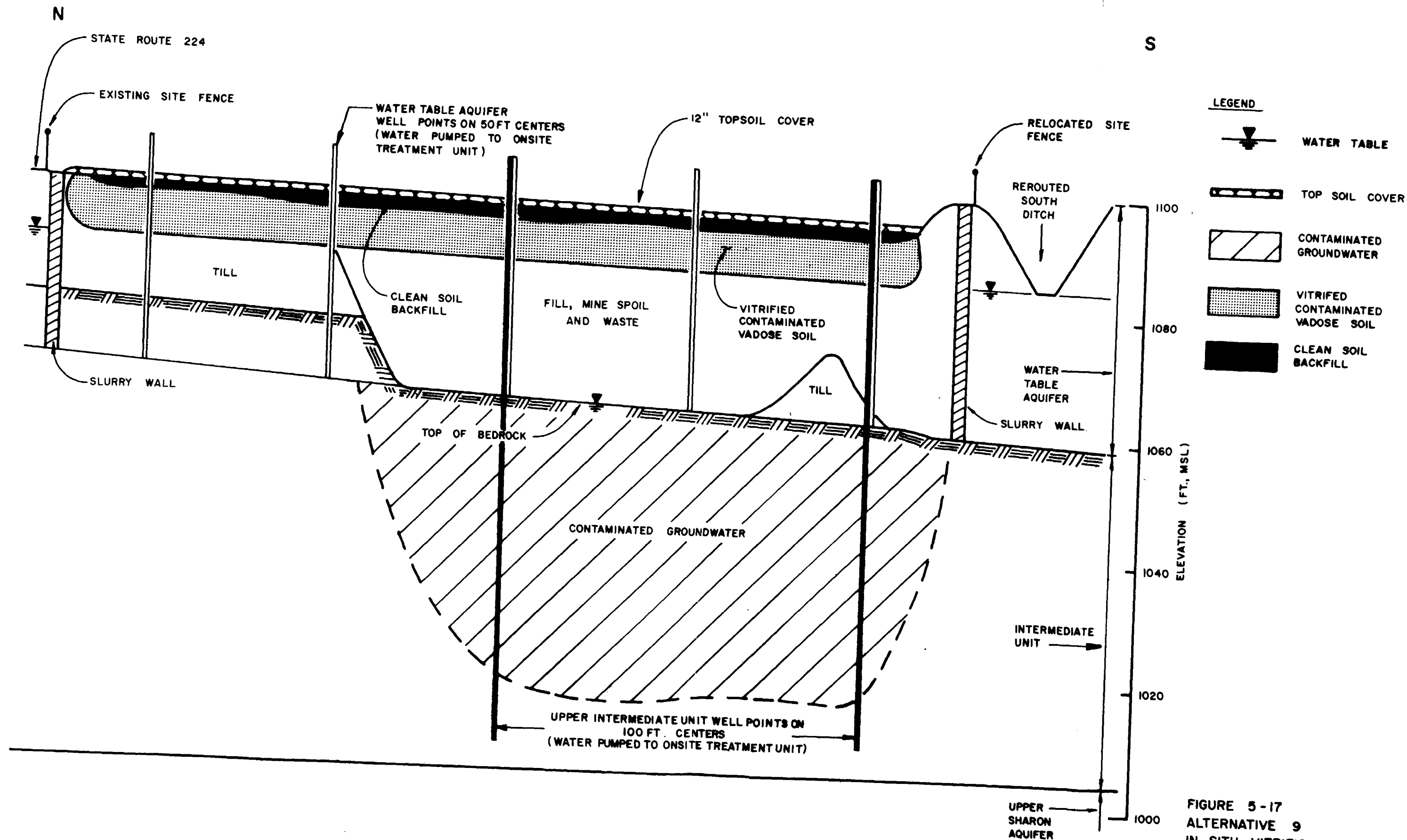


FIGURE 5-17  
 ALTERNATIVE 9  
 IN SITU VITRIFICATION OF  
 CONTAMINATED VADOSE SOIL  
 GENERALIZED NORTH-SOUTH  
 CROSS SECTION  
 SUMMIT NATIONAL FS

## CHAPTER 6

### DETAILED ANALYSIS OF ASSEMBLED ALTERNATIVES

This chapter presents the detailed analysis of the assembled alternatives developed in Chapter 5. The detailed analysis is in accordance with 40 CFR 300.68(h) of the NCP and the most recent available guidance on the effects of SARA on the analysis process. The detailed analysis included the evaluation of the effectiveness, implementability and costs of each of the nine alternatives.

The detailed analysis presented is not intended to be all inclusive and encompassing, but it is intended to present sufficient information concerning each alternative to allow a comparative evaluation. Additional information and considerations should be assessed during the detailed design of the selected alternative to better refine the implementation of the alternative. Numerous details will require additional evaluation and incorporation into the design if safeguards are to be provided to allow for proper system performance and reliability, as well as consideration of compatibility with other potential remedial actions for the site as a whole.

#### 6.1 EFFECTIVENESS EVALUATION OF ALTERNATIVES

This section presents an evaluation of the degree to which each alternative can satisfy the effectiveness criteria established by SARA. These criteria include:

- o Protectiveness: The degree to which the alternative reduces public health and environmental risks.
- o Reliability: The demonstrated performance of the technologies comprising the alternative under similar conditions, and operation and maintenance requirements.
- o ARARs: The ability of the alternative to meet applicable or relevant and appropriate requirements (ARARs) identified for the Summit National Site.

- o Reduction in Toxicity, Mobility, or Volume: The extent to which the alternative significantly and permanently reduces the mobility, toxicity or volume of contaminated material.

A summary of each alternative's compliance with potential ARARs for the site is presented, followed by discussions of results of the effectiveness evaluations for each of the assembled remedial alternatives.

#### COMPLIANCE WITH ENVIRONMENTAL STATUTES (ARARs)

In determining appropriate remedial actions at Superfund sites, consideration must be given to the requirements of other Federal and State environmental laws in addition to SARA. Primary consideration is given to attaining or exceeding applicable or relevant and appropriate environmental and public health requirements in laws, regulations, standards, and guidelines (ARARs).

Applicable laws and standards are those that would be specifically triggered when the law or regulation is clearly and indisputably the controlling authority for the planned action for that proposed Superfund remedy except that the proposed action would be undertaken pursuant to SARA. Section 104; e.g., applicable laws and standards are those that would legally apply if the reaction was not being taken under the authority of SARA.

Relevant and appropriate laws or standards are those where the intent of the law or standard is to apply to circumstances sufficiently similar to those encountered at Superfund sites. The term "relevant and appropriate" means that the law or regulation need not be truly applicable to or legally required for the proposed action or existing circumstances, but that the intent of the law was to control similar situations. The applicable or relevant environmental and public health standards are reviewed for each alternative and are summarized in Table 6-1.

Because the Summit National Site may affect the groundwater, compliance with EPA's proposed groundwater strategy should be considered. EPA's proposed groundwater strategy has developed guidelines which define protection policies for three classes of groundwater, based on their respective value and their

TABLE 6-1

COMPLIANCE WITH APPLICABLE OR RELEVANT AND APPROPRIATE  
LAWS, REGULATIONS, POLICIES, AND STANDARDS  
FOR THE SUMMIT NATIONAL ASSEMBLED ALTERNATIVES

Law, Regulation, Policy or Standard	Source of Regulation	Applicability or Relevance and Appropriateness	Alternative								
			1*	2	3	4	5	6	7	8	9
<b>FEDERAL</b>											
Resource Conservation and Recovery Act (RCRA)	RCRA Subtitle C, 40 CFR 260	RCRA regulates the generation, transport, storage, treatment, and disposal of hazardous waste. CERCLA specifically requires (in Section 104(c)(3)(B)) that hazardous substances from removal actions be disposed of at facilities in compliance with Subtitle C of RCRA.	NC	X	X	X	X	X	X	X	X
Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities	RCRA Section 3004, 40 CFR 264 and 265	Regulates the construction, design, monitoring, operation, and closure of hazardous waste facilities. Subparts M and O specify technical requirements for landfills and incinerators, respectively.	NC	X	X	X	X	X	X	X	X
Interim RCRA/CERCLA Guidance on Non-Contiguous Sites and Onsite Management of Waste and Treated Residue	U.S. EPA Policy Statement March 27, 1986	If a treatment or storage unit is to be constructed for onsite remedial action, there should be clear intent to dismantle, remove, or close the unit after the CERCLA action is completed. Should there be plans to accept commercial waste at the facility after the CERCLA waste has been processed, it is EPA policy that a RCRA permit be obtained before the unit is constructed.	NC	NA	X	X	X	X	X	X	X
Standards Applicable to Transporters of Hazardous Waste	RCRA Section 3003, 40 CFR 262 and 263, 40 CFR 170 to 179	Establishes the responsibility of offsite transporters of hazardous waste in the handling, transportation, and management of the waste. Requires a manifest, recordkeeping, and immediate action in the event of a discharge of hazardous waste.	NA	X	X	X	X	X	X	X	X
EPA Administered Permit Programs: The Hazardous Waste Permit Program	RCRA Section 3005, 40 CFR 270, 124	Covers the basic permitting, application, monitoring and reporting requirements for offsite hazardous waste management facilities.	NA	X	X	X	X	X	X	X	X
EPA Interim Policy for Planning and Implementing CERCLA Offsite Response Actions	50 FR 45933 November 5, 1985	Discusses the need to consider treatment, recycling, and reuse before offsite land disposal is used. Prohibits use of a RCRA facility for offsite management of Superfund hazardous substances if it has significant RCRA violations.	NA	X	X	X	X	X	X	X	X



Table 6-1 (cont'd)  
Page 3 of 4

Law, Regulation, Policy or Standard	Source of Regulation	Applicability or Relevance and Appropriateness	Alternative								
			1*	2	3	4	5	6	7	8	9
National Pollutant Discharge Elimination System (NPDES) Permit	Clean Water Act Section 402, 40 CFR 122, 123, 125 Subchapter N	Regulates the discharge of water into public surface waters.	NA	X	X	X	X	X	X	X	X
Toxic Pollutant Effluent Standards	40 CFR 129	Regulates the discharge of the following pollutants: aldrin/dieldrin, DDT, endrin, toxaphene, benzidine, and PCB's.	NA	X	X	X	X	X	X	X	X
U.S.EPA Groundwater Protection Strategy	U.S.EPA Policy Statement August 1984	Identifies groundwater quality to be achieved during remedial actions based on the aquifer characteristics and use.	NC	X	X	X	X	X	X	X	X
Conservation of Wildlife Resources	Fish and Wildlife Coordination Act	This act requires agency consultation prior to modifying any body of water.	NA	X	X	X	X	X	X	X	X
Occupational Safety and Health Act (OSHA)	29 CFR 1910	Regulates working conditions to assure safety and health of workers.	X	X	X	X	X	X	X	X	X
<b>STATE AND LOCAL</b>											
State Hazardous Waste Site Permit	Ohio Solid and Hazardous Waste Disposal Law and Ohio Hazardous Waste Management Regulations. Ohio Revised Code: 3734-01 through 99 and Ohio Administrative Code 3745-50 through 69.	If a new hazardous waste facility must be created to handle the wastes for longer than 90 days, state approval and/or generator I.D. may be required as a precondition.	NA	NA	X	X	X	X	X	X	X
Local Operating Permit or License for Remedy	Zoning, building or fire code, or local licensing laws.	Obtain local permit or license approving operation of site facilities.	NA	X	X	X	X	X	X	X	X
State Hazardous Waste Manifest and State Permit or License for Transport of Hazardous Waste	Ohio hazardous waste management, hazardous materials transport, or commercial driver licensing regulations. Ohio Administrative Code 3745-52, 53	In general, the manifest systems require the generator to obtain a permit to transport wastes on public rights-of-way within the state, to use only licensed transporters, and to designate only a permitted TSD facility to take delivery of wastes.	NA	X	X	X	X	X	X	X	X
Ohio NPDES Permit	Ohio Water Pollution Control. Ohio Administrative Code 3745-33, 40 CFR 123.	Regulates all point source discharges to surface waters of the state.	NC	X	X	X	X	X	X	X	X

Table 6-1 (cont'd)  
Page 4 of 4

Law, Regulation, Policy or Standard	Source of Regulation	Applicability or Relevance and Appropriateness	Alternative								
			1*	2	3	4	5	6	7	8	9
State Solid Waste Site Permit	Ohio Solid Waste and Licensing Requirements. Ohio Administrative Code 3745-27 and 37.	Regulations solid waste treatment, storage and disposal activities.	NA	NA	X	X	X	X	X	X	X
Ohio Water Quality Standards	Ohio Administrative Code 3745-1	Establishes minimum water quality criteria requirements for all surface waters of the state.	NC	X	X	X	X	X	X	X	X
State Permit Requirements for Emissions in Prevention of Significant Deterioration (PSD) Areas	Clean Air Act, Part C; State Implementation Plans, Ohio Administrative Code 3704 and 3745-17, 18, 21, 71	A major source of air pollutants such as NO <sub>2</sub> , SO <sub>2</sub> , CO, hydrocarbons, lead, and particulates in PSD area must be permitted by the state and is subject to requirements applicable to PSD areas.	NA	NA	NA	NA	NA	NA	NA	NA	NA
State Permit Requirements for Emissions in Non-Attainment Area	Clean Air Act, Part D; State Implementation Plans, and Ohio Administrative Code 3745-31, 35	If a major source is in a non-attainment area those pollutants for which it is a major source, it must comply with requirements applicable to non-attainment areas.	NA	NA	NA	NA	NA	NA	NA	NA	NA
Local Approval of Grading (Erosion Control) Permit (Ohio has requirements for erosion control)	Local grading ordinances or erosion control ordinances.	Requirements affecting land slope and cover, surface water management, alteration of natural contours, or cover by excavation or fill.	NA	X	X	X	X	X	X	X	X
Local Approval of Use Permit	Local Building Code	Demonstration through presentation of evidence or onsite inspection that remedial action complies with the requirements of local health and safety laws and ordinances.	NC	X	X	X	X	X	X	X	X
Local Building Permits (includes electrical, plumbing and HVAC)	Local Building Codes	Obtain permits for construction.	NA	X	X	X	X	X	X	X	X

**NOTES:**

- X - Alternative is in compliance
- NA - ARAR not applicable to specific alternative
- NC - Alternative not in compliance
- \* - Alternative 1, No Action, requires no ARARs



vulnerability to contamination. The shallow groundwater at the Summit National site would be considered Class II: current and potential sources of drinking water and waters having other beneficial uses. EPA's cleanup policy for Class II aquifers currently used as a drinking water source includes cleanup to drinking water standards or background, as appropriate.

For the alternatives developed for the Summit National Site, several federal and state environmental laws and regulations are not applicable. These laws and regulations, along with the reasons for their nonapplicability, are set out in Table 6-2.

#### ALTERNATIVE 1 - NO ACTION

Under the no action alternative, no remedial action would take place at the Summit National Site.

Protectiveness: Since no remedial actions would be implemented at the site for Alternative 1, the risks identified in the Public Health Evaluation, as summarized in Chapter 2 of this report, would not be mitigated. Under current-use conditions exposure to surface soil through direct contact and incidental ingestion by onsite trespassers, workers along the southern perimeter, and residents along the eastern perimeter were evaluated. Under the plausible maximum exposure scenarios, total excess cancer risks exceeded  $10^{-6}$  by at least one order of magnitude. Also under current use conditions, exposure to sediments in ditches by children, the plausible maximum exposure scenario resulted in a  $6 \times 10^{-6}$  total excess cancer risk. Future use scenarios evaluated use of the site by workers or reuse of the site for residential dwellings. Both of these scenarios resulted in plausible maximum exposure to surface soil through incidental ingestion that exceeded total excess cancer risks of  $10^{-6}$  by at least two orders of magnitude. In addition, under these future use scenarios it was assumed that the groundwater beneath the site would be used as a potable water supply. Total excess cancer risks to both workers and residents associated with ingestion of groundwater from the water table and intermediate unit exceeded  $10^{-6}$  under both average and plausible maximum exposure conditions. In addition, the total hazard index for exposure to workers and residents under average and plausible maximum conditions to the water table aquifer and the plausible maximum conditions to the intermediate unit exceeded one, indicating that non-carcinogenic health effects also may result from exposure to indicator chemicals in these units. This alternative is not protective.

TABLE 6-2

FEDERAL ENVIRONMENTAL LAWS AND REGULATIONS NOT APPLICABLE  
OR RELEVANT AND APPROPRIATE TO ALTERNATIVES  
FOR THE SUMMIT NATIONAL SITE

<u>Law or Regulation</u>	<u>Analysis</u>
Underground Injection Control Regulations	None of the alternatives include the underground injection of materials.
Ocean Dumping Requirements	Implementation of the alternatives does not include the dumping of any materials in the ocean.
Disposal of certain waste material containint TCDD (40 CFR Parts 260 to 267 Subpart J)	The contaminated materials to be disposed of or treated in any alternative do not contain TCDD as a contaminant.
Uranium Mill Tailing Rules	The site contains no uranium mill tailings.
Radioactive Waste Rule - High and Low Level	The site does not contain high- or low level radioactive waste.
Asbestos Disposal Rules	Asbestos was not measured at the site.
National Register of Historic Places	Implementation of the alternatives will not affect sites on the register.
Wild and Scenic Rivers Act	Rivers on the national inventory will not be affected by alternatives.
Protection of Threatened or Endangered Species and Their Habitats	Implementation of the alternatives will not affect threatened or endangered species and their habitat
Conservation of Wildlife Resource	Implemenation of the alternatives will not affect areas of important wildlife resources.
Coastal Zone Management	Implementation of the alternatives will not affect a coastal zone.
Toxic Substance Control Act	TSCA requirements apply to wastes containing PCB concentrations of 50 ppm or more. Site does not contain PCB at concentrations which would trigger TSCA requirements.
Permits for Discharges of Dredged or Fill Material Into Waters of the U.S. (Section 404 Permit)	Implementation of alternatives does not call for discharge into U.S. waters.

TABLE 6-2 (cont'd)  
Page 2 of 2

Law or Regulation

Great Lakes Water Quality  
Agreement of 1978

Statement of Procedures on  
Flood Plain Management and  
Wetland Protection

Pretreatment Regulations for  
Existing and New Sources of  
Pollution (40 CFR 403 Sub-  
chapter N, FWPCA)

Analysis

Site not part of Great Lakes basin ecosystem.

Site not located in or near a wetland or  
floodplain.

Implementation of alternative will not dis-  
charge to POTW.

Reliability: There is no reliable remediation associated with this alternative.

ARARs: This alternative does not satisfy health and environmental ARARs because environmental and public health problems associated with the site are not remediated.

Reduction in Toxicity, Mobility or Volume (TMV): The TMV of the contaminants are not reduced under this alternative.

#### ALTERNATIVE NO. 2 - RESIDENT RELOCATION WITH MONITORING

Alternative 2 involves the following major components:

- o Access/Deed Restrictions
- o Runoff Monitoring
- o Groundwater Monitoring
- o Relocation of Watson Residence

Protectiveness: This alternative provides a minimum of protection to public health and the environment. The extension and ongoing maintenance of the site fence to enclose all site-related soil contamination would reduce the risk of direct contact or incidental ingestion of onsite soil and sediment contaminants. Deed restrictions would prevent future use or development of the site. Contaminated soil, sediment, subsurface waste, and surface water would not be contained, thus the risk of contaminant migration off site would still exist. Runoff and groundwater monitoring would be employed to detect contaminant migration off site, at which point action could be taken to contain the contamination. An indeterminate amount of time would, however, elapse between detection and the implementation of mitigating measures, during which public health and environmental hazards would exist.

Relocation of the Watson residence to an uncontaminated location would protect the owner from potential health risks associated with contact and ingestion of contaminated soil and groundwater. Furthermore, if no other action is taken, the new Watson well could become contaminated at some time in the future.

Reliability: Site fencing and deed restrictions have limited demonstrated reliability. Properly maintained, the site fence would effectively eliminate trespassing. However, periodic disrepair of the fence could allow site access. Risks of exposure to onsite contaminated soil, sediment, subsurface waste, and surface water would still exist for birds and small animals capable of passing through the fence. The enforcement of deed restrictions in the future is uncertain. Monitoring is demonstrated and reliable for detecting contaminant migration; however, a lapse of time may occur between onset of migration and detection or detection and implementation of a mitigating action. The effective use of site fencing and monitoring requires continual, ongoing maintenance and operation.

Attainment of ARARs: This alternative may not attain ARARs since the technologies involved do not alter existing site conditions. See Table 6-1.

Reduction of Toxicity, Mobility, and Volume: Alternative 2 does not reduce toxicity, mobility, or volume of the onsite contaminants. Mobility is indirectly affected by monitoring, since monitoring will be used to detect contaminant migration and initiate mitigating actions. Risks of future release of concentrated contaminants from buried drums and tanks still exist.

#### ALTERNATIVE NO. 3 - CAPPING WITH DRUM INCINERATION

Alternative 3 involves the following major components:

- o Access/Deed Restrictions
- o Runoff Monitoring
- o Groundwater Monitoring
- o Multi-layer Cap
- o Vertical Barrier and Groundwater Extraction Wells
- o Excavation and Incineration of Buried Drums and Tanks
- o Excavation of Sediments and Placement Under Cap
- o Removal of Structures
- o Elimination of Onsite Surface Water
- o Water Treatment
- o Relocation of Watson Residence

**Protectiveness:** The combined components of this alternative will decrease the potential for direct contact with contaminated surface soil, sediment, and subsurface wastes. This alternative will be protective of public health by mitigating the risk from dermal absorption or incidental ingestion of contaminated soils and sediments. Components of this alternative that contribute to this reduction of risk from direct contact with soils include access/deed restriction and the installation of the multi-layer cap.

The deed restrictions would eliminate future potential exposure with contaminated soil and sediment by prohibiting future use or excavation of the site. Contaminated soil and sediment would be covered with a multi-layer cap, thereby eliminating risks of direct dermal contact or incidental ingestion.

The deed restrictions will also eliminate future potential exposure through ingestion of groundwater by prohibiting the use of groundwater directly under the site within the vertical barrier. Prohibiting use of groundwater will also achieve the remedial action goals of eliminating the dermal absorption and inhalation of extracted groundwater contaminants from future wells installed on site. It does not, however, protect from future potential exposure to contaminants that may first migrate downward below the vertical barrier then laterally off site. The removal of buried tanks and drums, and the destruction of their contents, will prevent the future release of contaminants from these tanks into the vadose zone and/or groundwater which will decrease the long-term potential health risks associated with ingestion of site groundwater.

The components directly contributing to protection from groundwater associated risks include installation of vertical barriers and groundwater extraction wells in the Water Table Aquifer and Upper Intermediate Unit, followed by water treatment. The barrier, in combination with groundwater extraction, will reduce the volume of groundwater moving off site and reduce the rate of downward contaminant movement toward the Upper Sharon aquifer; it will also reduce the contamination in the Upper Intermediate Unit. This remediation will reduce the migration of site contaminants in the Water Table Aquifer and Intermediate Unit towards and eventually into nearby residential wells, thus decreasing potential long-term health risks associated with groundwater

ingestion (although actual concentrations and estimated risks could not be determined in the PHE).

Elimination of onsite surface water will eliminate intermittent exposures to surface water through ingestion or absorption which may occur periodically when the onsite ponds overflow. The groundwater and surface water will be treated in the same manner in the onsite water treatment facility. The precipitation, coagulation/flocculation and filtration portion of this treatment will result in a sludge that will mainly be composed of inorganics. The carbon filter will absorb the remaining organics in the water. Treatment sludges and spent carbon will be transported off site for incineration. Both of these treatment processes may result in the addition of short-term risks associated with the handling and transportation of the sludge and filters.

The demolition of the onsite structures and excavation of buried drums may lead to short-term increases in fugitive dust levels and possibly volatile organics (depending on the composition of wastes in the tanks) which may in turn lead to short-term exposure and increased health risks to workers or nearby residents. However, dust control measures would be employed during implementation of any alternatives that have the potential to generate dust, thus mitigating the potential for health risks to result from exposure to fugitive dust. The resulting debris (building materials, tanks and crushed drums) from the mechanical excavation activities will be removed from the site and disposed of in appropriate offsite facilities. This removal may potentially introduce a short-term risk associated with the transportation of these materials.

Prior to installation of the multi-layer cap, the surface of the site would need to be graded. Grading and capping may lead to short-term increased exposure to fugitive dust. However, the site would be graded and capped with uncontaminated soils, and dust control measures would be employed during implementation of this alternative, thus decreasing any potential health risk. Relocating the southern ditch may also release fugitive dust.

The relocation of the Watson residence and the installation of a new water supply well will protect the owner from potential health risks associated with contact and ingestion of contaminated soils and groundwater.

While installation of a vertical groundwater barrier may have the potential to release fugitive dust to the atmosphere, the areas where the barrier will be installed do not contain substantial quantities of contaminants in the subsurface soils and exposure through inhalation is considered unlikely to pose a significant health risk.

If this alternative would be selected, an alternate drinking water supply would need to be provided to any user of groundwater within 1,000 ft. of the site in order to satisfy requirements of the Ohio Solid Waste Act.

**Reliability:** All major components of this alternative have demonstrated reliabilities for preventing exposure through direct contact, ingestion, or inhalation. The only technology that provides reliability in terms of risk reduction is the excavation and offsite incineration of buried drum and tank contents, and treatment and discharge of contaminated surface water. While the other components of this alternative do have reliable long term performance records, there is a potential for future release/exposure of contamination should the constructed system fail or deteriorate. This potential can be mitigated through maintenance. Long-term operation and maintenance requirements consist of maintaining the cap, fence inspection and repair, the operation of the groundwater extraction system, the operation of the water treatment plant, and runoff and groundwater monitoring activities for 30 years after closure for verification of alternative performance.

**Attainment of ARARs:** The technologies designed for use in Alternative 3 should achieve applicable ARARs.

**Reduction of Toxicity, Mobility and Volume:** Alternative 3 significantly reduces both the volume and the mobility of onsite contaminants. The volume of contaminants on site is reduced by the excavation and incineration of the buried drum and tank contents, which are a major known onsite source of contamination. The incineration of the buried drum and tank contents eliminates



the potential toxic effects of the organic fraction of these wastes. The contaminated water within the onsite ponds will be collected and treated, and the ponds will be backfilled, which eliminates that source of contamination. Additionally, the water within the Water Table Aquifer will be withdrawn and treated prior to discharge. Over an extended period of time, this withdrawal will reduce contaminant concentrations within the groundwater and the saturated materials. The mobility of the contaminants will be reduced by the cap which reduces erosion of contaminated soils and subsequent offsite migration. The construction of the vertical barrier and groundwater withdrawal system reduces the rate of groundwater migration away from the site. The cap also reduces infiltration of water through the vadose zone materials which transport materials downward toward the groundwater.

#### ALTERNATIVE NO. 4 - ONSITE RCRA LANDFILL

The components of Alternative 4 are the same as those in Alternative 3, with the exception that the onsite materials within the vadose zone will be excavated and placed into an onsite RCRA landfill.

Protectiveness: Risks introduced or reduced for the appropriate components of Alternative 3 also apply to Alternative 4.

The RCRA landfill will have a double liner for leachate collection and detection. The long-term risks associated with direct contact with, or ingestion of, surface and subsurface soil and sediments will be further reduced through the addition of this technology. Additionally, under this alternative, contaminated soils within the vadose zone and sediments are contained, reducing their potential to migrate into the groundwater or to be transported in runoff into surface water. Migration will be reduced as long as the liner system remains intact and functions properly. The materials in the RCRA landfill may generate leachate which will be treated in the onsite treatment system.

Reliability: All major components of this alternative have demonstrated reliabilities for preventing exposure through direct contact, inhalation or ingestion. However, the disposal of waste within a RCRA landfill is not a proven, long-term technology. There may be

future problems associated with the landfill. Long-term operation and maintenance requirements consist primarily of maintaining the cap, fence inspection and repair, the operation of the water treatment plant, and runoff and groundwater monitoring activities for 30 years after closure to verify alternative performance. Additionally, the double liner system will also require periodic maintenance.

Attainment of ARARs: All technologies designed for use in Alternative 4 should achieve ARARs.

Reduction of Toxicity, Mobility and Volume: As with Alternative 3, Alternative 4 will reduce the volume of wastes on site by the excavation and incineration of buried drum and tank wastes, elimination of onsite ponds, and the withdrawal of contaminated water within the water-table aquifer. Alternative 4 also reduces the mobility of the waste by the installation of the cap and the groundwater withdrawal system, as in Alternative 3. Alternative 4 reduces the mobility of the contamination to a greater extent than Alternative 3 by enclosing the contaminated vadose materials within an onsite double liner system. This liner will further reduce the migration of contaminants downward from the vadose zone and into the groundwater.

#### ALTERNATIVE NO. 5 - THERMAL TREATMENT OF "HOT SPOT" SOIL

Alternative 5 consists of the same technologies as Alternative 4, except for the soils operable unit. Rather than direct enclosure of the vadose soils in the onsite RCRA landfill, Alternative 5 would isolate and separately collect the "hot spot" soils located south of the onsite ponds and include the onsite incineration of this soil, subsurface wastes and contaminated sediments. The ash generated by the incineration process would be placed in an onsite RCRA landfill constructed above the onsite excavation. The incineration of these materials would destroy organic contaminants, but would not affect inorganic contaminant concentrations.

Protectiveness: The majority of the components of Alternative 5 and associated risks are similar to those of Alternative 4. The only change is that the "hot spot" soils, the contents of the buried drums, and tanks and contaminated sediments will be incinerated for organics removal and the remaining ash will be returned to a RCRA landfill constructed above the onsite excavation. Incineration is to take place using

an onsite mobile incinerator. Onsite incineration may result in short-term low level emissions of organics in the soil feed, as well as products of incomplete combustion. In addition, incineration will not thermally destroy inorganics. Since there will be an air pollution control system on the incinerator to decrease emissions of particulate matter to permitted levels and inorganics are predominantly adsorbed to particulate matter, emissions of inorganics (some of which are probable human carcinogens by inhalation) will not be excessive. Thus, although incineration may result in short-term exposure to low levels of airborne contaminants, a long-term source of groundwater contaminants will be removed from the site, decreasing the potential long-term health risks associated with ingestion of groundwater. Destruction of organic contaminants in the "hot spot" soils and contaminated sediments also provides protection from potential risk due to the digestion of, or contact with, the materials. The estimated overall upperbound lifetime cancer risk associated with soils not removed in this scenario is  $3 \times 10^{-5}$  (See Appendix A). As with Alternative 4, the potential for migration of contaminants contained within the RCRA landfill is greatly reduced. The potential for leachate generation and contaminant migration is greater than Alternative 4, but less than Alternative 3. As with Alternative 4, any leachate generated would be extracted and treated in the onsite treatment unit.

**Reliability:** Incineration is a proven technology for the destruction of organic contaminants in the onsite soils and subsurface wastes. In order to achieve compliance with applicable Federal and State ARARs, the incinerator is required to have a high organic destruction efficiency, (99.99%) making it an extremely reliable technology. The incineration reduces some of the risks associated with the long-term disposal of contaminants in a RCRA landfill. All other major components of this alternative are proven in achieving remedial action goals. The long-term O & M requirements of this alternative include maintenance of the cap and fence, operation of the groundwater extraction and treatment system, and the performance of groundwater monitoring to permit verification of alternative performance.

**Attainment of ARARs:** The technologies designed for use in Alternative 5 should achieve ARARs. See Table 6-1.

**Reduction of Toxicity, Mobility and Volume:**

Alternative 5 reduces contaminant volume by the excavation and incineration of buried drum and tank wastes, elimination of onsite ponds, and the withdrawal and treatment of contaminated groundwater as in Alternative 3. As with Alternative 4, this alternative reduces mobility of contaminants by installation of the cap, the construction of the vertical barrier and groundwater withdrawal systems, and the placement of materials in a RCRA landfill constructed above the onsite excavation. This alternative further reduces the volume and toxicity of contaminants on site by destroying the organic contaminants currently present in the "hot spot" soils by incineration.

Incineration has a high removal and destruction efficiency for organics which will significantly reduce the toxicity of these contaminants. The potential toxic risks associated with the generated ash will be less than those already existing from current onsite inorganic contamination due to encapsulation of treated soils within the onsite RCRA landfill. .

**ALTERNATIVE NO. 6 - THERMAL TREATMENT OF VADOSE SOIL**

Alternative 6 consists of the same technologies as Alternative 5, with the addition of thermal treatment for all vadose soils rather than just "hot spot" areas. Alternative 6 would include the onsite incineration of vadose soil, sediments and subsurface wastes. The ash generated by the incineration process would also be returned to an onsite RCRA landfill constructed above the onsite excavation. The incineration of these materials would destroy organic contaminants, but would not affect inorganic contaminant concentrations.

**Protectiveness:** The components of Alternative 6 and associated risks are the same as Alternative 5. The only change is that all vadose soils and excavated sediments instead of just "hot spot" soils will be incinerated for organics removal and the remaining ash will be returned to a RCRA landfill constructed above the onsite excavation. The same incineration scenarios and control measures detailed for Alternative 5 will apply to Alternative 6. Alternative 6 will also decrease the potential long-term health risks associated with ingestion of groundwater. Destruction of organic contaminants in the vadose soils also provides protection from potential risk due to the ingestion of, or contact with, the soils. Greater

protection is provided over Alternative 5 since more contaminated soils will be incinerated. A longer duration of treatment would, however, be required before the greater level of protection is achieved.

Reliability: Again, incineration is a proven technology for the destruction of organic contaminants in the onsite vadose soils, sediments and subsurface wastes. In order to achieve compliance with Federal and State ARARs, the incinerator is required to have a high destruction efficiency, making it an extremely reliable technology. The incineration reduces some of the risks associated with the long-term disposal of contaminants in an onsite RCRA landfill. All other major components of this alternative are proven in achieving remedial action goals. The long-term O & M requirements of this alternative include maintenance of the cap and fence, operation of the groundwater extraction and treatment system, and the performance of groundwater monitoring to evaluate alternative performance.

Attainment of ARARs: All technologies designed for use in Alternative 6 should achieve ARARs. See Table 6-1.

Reduction of Toxicity, Mobility and Volume: Alternative 6 reduces contaminant volume by the excavation and incineration of buried drum and tank wastes, elimination of onsite ponds, and the withdrawal and treatment of contaminated groundwater as in Alternatives 3, 4 and 5. This alternative further reduces the volume and toxicity of contaminants on site by thermally destroying the organic contaminants currently present in the vadose soils and sediments, in addition to the "hot spot" soils. The reduction in toxicity and mobility of contaminants for this alternative is greater than Alternatives 3, 4 and 5 as a larger volume of contaminated material is treated and contained within the onsite RCRA landfill.

#### ALTERNATIVE NO. 7 - THERMAL TREATMENT OF UNCONSOLIDATED MATERIAL TO BEDROCK

This alternative includes the same technologies as Alternative 6, with the additional excavation and treatment of all unconsolidated materials to bedrock, rather than only contaminated vadose soils and sediments. All other components, with the exception of Water Table Aquifer extraction wells, which are replaced by drains, are the same as Alternative 6.

**Protectiveness:** This alternative includes the same components and risks as Alternative 6. The fact that a larger volume of material is being treated results in a greater level of protectiveness than Alternative 6. Again, the soils will be disposed in a RCRA landfill constructed above the onsite excavation after treatment; however, a larger facility will be required. The short-term exposure and risks associated with this alternative are greater than those associated with Alternative 6 due to the longer duration of treatment.

**Reliability:** Again, incineration is a proven technology for the destruction of organic contaminants in the unconsolidated materials and subsurface wastes. In order to achieve compliance with Federal and State ARARs, the incinerator is required to have a high destruction efficiency, making it an extremely reliable technology. The incineration reduces some of the risks associated with the long-term disposal of contaminants in an onsite RCRA landfill. All other major components of this alternative are proven reliable in achieving remedial action goals. The long-term O & M requirements of this alternative include maintenance of the cap and fence, operation of the groundwater extraction and treatment system, and the performance of groundwater monitoring to permit evaluation of alternative performance.

**Attainment of ARARs:** All technologies designed for use in Alternative 7 should achieve ARARs. See Table 6-1.

**Reduction of Toxicity, Mobility and Volume:** Alternative 7 reduces the volume and toxicity of organic contaminants which will be present in the unconsolidated materials placed in the onsite landfill following treatment by thermal processes. As this alternative treats a much greater soil volume than Alternative 6, it provides a greater reduction in contaminant toxicity, mobility and volume.

#### **ALTERNATIVE 8 - IN SITU VITRIFICATION OF "HOT SPOT" SOIL**

The components of Alternative 8 are similar to those for Alternative 5, Thermal Treatment of "Hot Spot" Soil, with the major difference being that in this alternative the "hot spot" soil and sediments would be treated by in situ vitrification (ISV) rather than onsite incineration. ISV treatment would destroy the organic soil contaminants, while inorganic contaminants

would be encapsulated in the resulting vitreous mass. One other difference would be that the drums and tank contents would be transported offsite for incineration, rather than treated onsite as in Alternative 5.

Protectiveness: The majority of the components of Alternative 8 are the same as those of Alternative 5, thus the risks associated with these components would be similar. The major difference between Alternative 5 and 8 is the manner in which the "hot spot" soil would be treated. ISV treatment would effectively destroy all organic contaminants in the soil. The total system DRE for ISV treatment of organic contaminants is approximately 99.99%, and 99.9999% for PCBs. ISV has not been tested or proven effective for treatment of all organic contaminants present in the soil; however, similar treatment efficiency should be attainable for most contaminants. The inorganic contaminants and any residual organic contaminants would be encapsulated in the resultant vitreous mass. The leach rates from the vitreous material are very low (approximately  $5 \times 10^{-5}$  g/cm<sup>2</sup>/day) and should allow the potential for delisting of treated material.

Alternatives 5 and 8 provide similar destruction of organic contaminants. This alternative provides a slight increase in protectiveness over Alternative 5 since inorganics in the treated material are effectively immobilized in the resultant treatment product. The predicted life span of the ISV treated material (in excess of 1,000 years) is much greater than that for a lined landfill and the vitrified material would not require maintenance. Both An additional benefit of ISV over incineration is that the soil can be treated in place via ISV. This reduces short-term exposure risks considerably compared to alternatives requiring excavation of contaminated soil for treatment. However, the potential does exist for release of hazardous off-gas during treatment process operation. The use of the fume hood and subsequent vapor phase treatment system should minimize this risk. The offsite transport of drums necessitated by this option also exposes a larger portion of the population to potential risks associated with the drums.

Capping of untreated portions of the site would provide protection of public health and the environment. Long-term maintenance would be required for the cap and for the groundwater extraction system.

**Reliability:** In situ vitrification is an innovative technology without an extensive record of proven performance. Forty-six pilot, bench, and engineering scale tests, as well as five large scale tests, indicate that this technology should be an effective method of hazardous waste treatment. This technology has not been tested in a multi-contaminant situation such as exists at the Summit National Site. However, due to the nature of the ISV process, the presence of a wide range of contaminants should not significantly affect performance.

Other major technologies included in this alternative are proven in reducing direct contact, infiltration, or groundwater migration. Long-term operation and maintenance is required for the cap, the groundwater extraction system, and the water treatment system.

**Attainment of ARARs:** All technologies employed in this alternative should achieve ARARs. See Table 6-1.

**Reduction of Toxicity, Mobility and Volume:** In situ vitrification provides DRE values for organic contaminants similar to incineration. The reduction of mobility is greater than that in previous alternatives since undestroyed material (i.e., inorganic contaminants) would be incorporated into a solid form with low leach characteristics rather than being contained in a lined landfill system.

Soil outside the "hot spot" area would not be treated, and therefore would experience no reduction in toxicity, mobility, or volume. Mobility of contaminants in this area would be reduced by the multi-layer cap.

#### **ALTERNATIVE NO. 9 - IN SITU VITRIFICATION OF VADOSE SOILS**

Alternative 9 consists primarily of the same technologies as Alternative 8, with the addition of in situ vitrification for all vadose soils, rather than just "hot spot" areas. The only other difference is that the multi-layer cap covering the site in Alternative 8 is replaced by a simple soil cover in this alternative.

**Protectiveness:** This alternative includes the same components and therefore, risks as Alternative 8. The fact that a larger volume of material is being treated results in a greater level of protectiveness being achieved than that provided by Alternative 8.



Reliability: In situ vitrification is a relatively new and innovative technology without an extensive record of proven performance. However, due to the nature of the ISV process, the presence of a wide range of contaminants should not significantly affect performance.

Other major technologies included in this alternative are proven in reducing direct contact or groundwater migration. Long-term operation and maintenance is required for the soil cover, the groundwater extraction system and the water treatment system.

Attainment of ARARs: All technologies employed in this alternative should achieve ARARs. See Table 6-1.

Reduction in Toxicity, Mobility and Volume: Due to the greater volume of material being treated in this alternative, when compared to Alternative 8, a further reduction in contaminant toxicity, mobility and volume is achieved.

## 6.2 IMPLEMENTABILITY EVALUATION OF ALTERNATIVES

This section presents an evaluation of the degree to which each alternative can satisfy implementability criteria. These criteria include:

- o Technical Feasibility: The relative ease of implementing or completing an action based on site specific constraints, including the use of established technologies.
- o Availability: The availability of the technologies (materials or services) required to implement an alternative.
- o Administrative Feasibility: The potential community acceptance of an alternative and possible responses which could hinder alternative implementation.

### ALTERNATIVE 1 - NO ACTION

No remediation will be implemented at the site for this alternative.

Technical Feasibility: This evaluation is not applicable since there are no remedial technologies to implement.

Availability: This evaluation is not applicable since there are no technologies for which availability needs to be assessed.

Administrative Feasibility: Public (or community) acceptance of the following alternative cannot be determined at this time. An analysis of community concerns will be completed after the 28-day public comment period.

#### ALTERNATIVE 2 - RESIDENT RELOCATION WITH MONITORING

Technical Feasibility: The moving of a residential dwelling, especially a framed structure as the Watson residence, is not a common practice, but can be implemented by a specialized contractor. The relocation will require care to minimize damage to the structure. Runoff and groundwater monitoring methodologies are readily available and can be implemented by numerous environmental consultants.

Availability: The technologies to be used to implement this alternative are readily available since they involve the use of standard construction and environmental monitoring techniques.

Administrative Feasibility: The U.S. EPA must work closely with the Watsons and the community to allay possible concerns about resident relocation. U.S. EPA must be thorough in advising local officials and residents about the remedial action planned for the site, and how the relocation will be incorporated into it.

#### ALTERNATIVE 3 - CAPPING WITH DRUM INCINERATION

Technical Feasibility: The excavation and removal of the buried drums may be difficult due to the probable random nature of the drum orientations, the difficulties of removing drums from soil masses, and the implementation of the health and safety procedures that will be necessary to perform the excavations and drum handling. Additionally, the overpacking of leaking drums will also increase the difficulty of implementing this action. The relocation of the Watson residence will require care to minimize damage to the structure, but is easily implementable by experienced specialty contractors. The installation of the groundwater extraction and water treatment systems and

the vertical barrier are tasks that can be performed easily by specialty subcontractors. The remaining technologies, including grading, structure demolition, ditch relocation and capping, can be easily implemented using standard construction techniques and equipment.

Availability: The technologies that will be utilized on site to implement Alternative 3 are all readily available since they primarily involve the use of standard construction techniques and materials. These include the installation of the vertical barrier and the groundwater extraction system, relocation of the drainage ditches, site grading and capping, excavation of drums, and relocation of the Watson home. The incineration of the buried drummed materials may encounter some difficulties in scheduling of the wastes into a commercial facility, but since the volume of materials to be treated is small, this should not delay implementation of the alternative. Additionally, the water treatment system utilizes common technologies that are commercially available.

Administrative Feasibility: Public (or community) acceptance of the following alternative cannot be determined at this time. An analysis of community concerns will be completed after the 28-day public comment period. The Agency should work carefully with the community to address concerns and, where appropriate, incorporate community suggestions into the remedial design and action.

The U.S. EPA should also work closely with adjacent landowners to acquire necessary portions of the Watson and cement plant properties needed to implement remediation.

#### ALTERNATIVE 4 - RCRA LANDFILL FOR VADOSE SOIL

Technical Feasibility: The implementation of this alternative will require double handling of materials to allow excavation of vadose materials, the installation of the lining system of a RCRA landfill in the open excavation, and the subsequent replacement of the material within the lined portion of the excavation. Due to the constraints of the present site boundary and contaminants identified east of the site, the property to the east of the site will be used for

temporary storage to allow the construction to proceed. The construction of the landfill on site will be a complicated process, but is technically feasible. Special design alterations to the RCRA landfill may be required due to the high groundwater level at the site. The other technology that may be somewhat difficult to implement is the excavation of the buried drums for the reasons outlined for Alternative 3. The other technologies in Alternative 4 are the same as Alternative 3 and are easily implemented.

Availability: The technologies that are included in Alternative 4 utilize standard construction materials and techniques which are readily available in the region in which the site is located. These materials would include both natural and synthetic components of the liner system and leachate collection system. There should be no problems with the availability of these technologies during the implementation of Alternative 4.

Administrative Feasibility: Public (or community) acceptance of the following alternative cannot be determined at this time. An analysis of community concerns will be completed after the 28-day public comment period. The Agency should work carefully with the community to address concerns and, where appropriate, incorporate community suggestions into the remedial design and action.

The U.S. EPA should also work closely with adjacent landowners to acquire necessary portions of the Watson and cement plant properties needed to implement remediation.

#### ALTERNATIVES 5, 6 AND 7 - THERMAL TREATMENT OF "HOT SPOT," VADOSE SOILS, OR ALL UNCONSOLIDATED MATERIALS

Technical Feasibility: Alternatives 5, 6 and 7 will involve the same complicated double handling of materials to place them in an onsite RCRA landfill as discussed for Alternative 4, with the added complication of incinerating the materials while they are being held prior to replacement in an onsite RCRA landfill after treatment. Additionally, as with Alternative 4, special design alterations to the RCRA landfill design may be required due to the high groundwater level at the site.

These alternatives add the complication of handling the materials as both soils and sediments, and as an ash. The feasibility of the other technologies is the same as those discussed for Alternative 4 and can be easily implemented.

The extremely large volume of material to be handled in Alternative 7 could result in this being a difficult alternative to implement.

Availability: The mobile incinerator to be placed on site for approximately 5 years to incinerate contaminated "hot spot" soils and sediments and drummed waste materials may not be readily available due to the current demand for the units. The length of time to incinerate the vadose soils will be approximately nine years, and would require two units which may create a greater availability problem. The incineration of all unconsolidated materials would require two units with a larger capacity than in Alternative 6, and they would be required for approximately 12 years. This may also result in an availability problem. The other technologies that will be utilized are the same as those specified for Alternative 3, with the exception of onsite drum incineration, which are all readily available.

Administrative Feasibility: Public (or community) acceptance of the following alternative cannot be determined at this time. An analysis of community concerns will be completed after the 28-day public comment period. The Agency should work carefully with the community to address concerns and, where appropriate, incorporate community suggestions into the remedial design and action.

The U.S. EPA should also work closely with adjacent landowners to acquire necessary portions of the Watson and cement plant properties needed to implement remediation.

ALTERNATIVES 8 AND 9 - IN SITU VITRIFICATION OF "HOT SPOT" OR VADOSE SOILS

Technical Feasibility: These alternatives parallel Alternatives 5 and 6, which have been previously discussed, with the exception of the use of in situ vitrification (ISV) as the method of soil treatment.

There appear to be few site constraints affecting the use of ISV, and it appears feasible as a soil treatment method, even though it is not an established technology. Special care should be exercised, however, when the depth of vitrification is approaching the groundwater level. At these depths, successful vitrification becomes extremely difficult.

Availability: It appears that the equipment necessary to perform ISV is available from a limited number of sources. The Battelle Memorial Institute, who operates the Pacific Northwest Laboratory, has reportedly been granted exclusive worldwide rights to all ISV technology, except for the use of ISV on radioactive wastes.

Due to the limited number of ISV units, availability may be a problem. The providers of the equipment and technology may also be hesitant to commit their services for a period of time from 3 to 7 years due to the limited number of units in existence.

Administrative Feasibility: Public (or community) acceptance of the following alternatives cannot be determined at this time. An analysis of community concerns will be completed after the 28-day public comment period. The Agency should work carefully with the community to address concerns and, where appropriate, incorporate community suggestions into the remedial design and action.

The U.S. EPA should also work closely with adjacent landowners to acquire necessary portions of the Watson and cement plant properties needed to implement remediation.

### 6.3 COST ANALYSIS

General Discussion: Cost estimates for the assembled alternatives were prepared from cost information included in the U.S. EPA's "Compendium of Costs of Remedial Technologies at Hazardous Waste Sites," the 1987 Means Site Work Cost Data guide, U.S. EPA's "Remedial Action at Waste Disposal Sites Handbook," estimates for similar projects, and estimates provided by equipment vendors.

Capital and operation and maintenance cost estimates are order-of-magnitude level estimates, that is, the cost estimates have an expected accuracy of +50 and -30 percent. The estimated present worth of remedial alternatives was based on 3, 5 and 10 percent discount rates and a 30-year alternative life.

The order-of-magnitude cost estimates presented have been prepared from the information available at the time of the estimate. Final costs of assembled alternatives will depend on actual labor and material costs, actual site conditions, productivity, competitive market conditions, final project scope, final project schedule, continuity of personnel, engineering between the feasibility study and final design, and other variable factors. As a result, the final alternative costs will vary from the estimates presented in this report. Most of these factors are not expected to affect the relative cost differences between alternatives. Factors that may substantially affect the relative cost difference are discussed under "Cost Sensitivity Analysis." Because of these factors, funding needs must be carefully reviewed prior to making specific financial decisions or establishing final budgets.

Estimated capital costs, annual operation and maintenance costs, and present worth for each alternative, except No Action, are presented in Tables 6-3 through 6-10.

Assumptions: Total capital costs are those expenditures required to initiate and install a remedial action. Both direct and indirect costs are considered in the development of capital costs. Direct costs include construction costs or expenditures for equipment, labor and materials required to install a remedial action. Indirect costs consist of engineering, permitting, supervising, and other services necessary to carry out a remedial action.

Table 6-3

Cost Estimate Summary  
Alternative 2  
Resident Relocation with Monitoring

Item	Capital Cost	Annual O & M	Present Worth O&M/Replacement 3%	30 Years Replacement 5%	10%
<hr/>					
I. WATSON RELOCATION					
Move Watson Residence	\$21,000				
Extend Site Boundary	\$20,000				
Extend Site Fence	\$20,000	\$1,000	\$20,000	\$15,000	\$9,000
II. MONITORING					
Runoff Monitoring		\$16,000	\$310,000	\$250,000	\$150,000
Groundwater Monitoring	\$32,000	\$54,000	\$1,100,000	\$830,000	\$510,000
<hr/>					
CONSTRUCTION SUBTOTAL	\$93,000		\$1,400,000	\$1,100,000	\$670,000
Health and Safety (10%)	\$9,000				
Bid Contingency (15%)	\$14,000				
Scope Contingency (20%)					
<hr/>					
CONSTRUCTION TOTAL	\$120,000				
Permitting & Legal (5%)	\$6,000				
Services During Construction (8%)	\$10,000				
<hr/>					
TOTAL IMPLEMENTATION COST	\$140,000				
Engineering & Design (10%)	\$14,000				
<hr/>					
TOTAL CAPITAL COSTS	\$150,000				
PRESENT WORTH			\$1,600,000	\$1,300,000	\$820,000



Table 6-4

Cost Estimate Summary  
Alternative 3  
Capping with Drum and Tank Incineration

Item	Capital Cost	Annual O & M	Present Worth		
			O&M/Replacement 3%	30 Years 5%	10%
<b>I. GENERAL SITE PREPARATION</b>					
Decontamination Facility	\$10,000				
Move Watson Residence	\$21,000				
Extend Site Boundary	\$20,000				
Extend Site Fence	\$20,000	\$1,000	\$20,000	\$15,000	\$9,000
Reroute S. Drainage Ditch	\$75,000				
Diversion Berm	\$30,000				
Demolition of Site Structures	\$54,000				
Removal & Incineration of Drums & Tanks	\$1,300,000				
Regrading	\$240,000				
<b>II. MULTI-LAYER CAP</b>					
Clay Layer	\$670,000				
HDPE Liner	\$310,000	\$5,000	\$98,000	\$77,000	\$47,000
Drainage Layer	\$220,000				
Vegetative Soil Layer	\$580,000		\$250,000	\$180,000	\$86,000 *
Revegetation	\$20,000	\$1,000	\$55,000	\$40,000	\$21,000 *
<b>III. GROUNDWATER</b>					
Slurry Wall	\$690,000				
Wells in Water Table Aquifer	\$1,200,000	\$180,000	\$3,500,000	\$2,800,000	\$1,700,000
Oil Skimmers	\$90,000				
Wells in Upper Intermediate Unit	\$82,000	\$15,000	\$290,000	\$230,000	\$140,000
5 Year Pump Replacement			\$810,000	\$610,000	\$340,000
<b>IV. WATER TREATMENT</b>					
Total System 50 GPM	\$250,000	\$87,000	\$1,700,000	\$1,300,000	\$820,000
<b>V. MONITORING</b>					
Mobile Laboratory	\$97,000				
Runoff Monitoring		\$16,000	\$310,000	\$250,000	\$150,000
Groundwater Monitoring	\$32,000	\$54,000	\$1,100,000	\$830,000	\$510,000
<b>CONSTRUCTION SUBTOTAL</b>	<b>\$6,000,000</b>		<b>\$8,100,000</b>	<b>\$6,300,000</b>	<b>\$3,800,000</b>
Health and Safety (10%)	\$600,000				
Bid Contingency (15%)	\$900,000				
Scope Contingency (20%)	\$1,200,000				
<b>CONSTRUCTION TOTAL</b>	<b>\$8,700,000</b>				
Permitting & Legal (5%)	\$440,000				
Services During Construction (8%)	\$700,000				
<b>TOTAL IMPLEMENTATION COST</b>	<b>\$10,000,000</b>				
Engineering & Design (10%)	\$1,000,000				
<b>TOTAL CAPITAL COSTS</b>	<b>\$11,000,000</b>				
<b>PRESENT WORTH</b>			<b>\$19,000,000</b>	<b>\$17,000,000</b>	<b>\$15,000,000</b>

\* Present worth calculated assuming replacement of 30% topsoil, regrading, and revegetating every 10 yrs.

Table 6-5

Cost Estimate Summary  
Alternative 4  
RCRA Landfill for Vadose Soil

Item	Capital Cost	Annual O & M	Present Worth		
			O&M/Replacement 3%	30 Years 5%	10%
<b>I. GENERAL SITE PREPARATION</b>					
Decontamination Facility	\$14,000				
Move Watson Residence	\$21,000				
Extend Site Boundary	\$20,000				
Extend Site Fence	\$20,000	\$1,000	\$20,000	\$15,000	\$9,000
Reroute S. Drainage Ditch	\$73,000				
Diversion Barn	\$30,000				
Demolition of Site Structures	\$54,000				
Removal & Incineration of Drums & Tanks	\$1,300,000				
<b>II. EXCAVATION &amp; PLACEMENT OF CONTAMINATED SOIL</b>					
Excavation	\$580,000				
Grading Waste Pit	\$190,000				
Backfill Contaminated Soil and Compact	\$1,100,000				
<b>III. DOUBLE LINER SYSTEM</b>					
Clay Layer	\$670,000				
Drainage System	\$260,000				
HDPE Liner	\$520,000	\$5,000	\$98,000	\$77,000	\$47,000
Geotextile	\$180,000				
<b>IV. MULTI-LAYER CAP</b>					
Clay Layer	\$670,000				
HDPE Liner	\$310,000	\$5,000	\$98,000	\$77,000	\$47,000
Drainage Layer	\$220,000				
Vegetative Soil Layer	\$580,000		\$250,000	\$180,000	\$86,000 *
Revegetation	\$20,000	\$1,000	\$55,000	\$40,000	\$21,000 *
<b>V. GROUNDWATER</b>					
Slurry Wall	\$690,000				
Wells in Water Table Aquifer	\$1,200,000	\$180,000	\$3,500,000	\$2,800,000	\$1,700,000
Oil Skimmers	\$90,000				
Wells in Upper Intermediate Unit	\$82,000	\$15,000	\$290,000	\$230,000	\$140,000
5 Year Pump Replacement			\$810,000	\$610,000	\$340,000
<b>VI. WATER TREATMENT</b>					
Total System 50 GPM	\$250,000	\$87,000	\$1,700,000	\$1,300,000	\$820,000
<b>VII. MONITORING</b>					
Mobile Laboratory	\$190,000				
Runoff Monitoring		\$16,000	\$310,000	\$250,000	\$150,000
Groundwater Monitoring	\$32,000	\$54,000	\$1,100,000	\$830,000	\$510,000
<b>CONSTRUCTION SUBTOTAL</b>	<b>\$9,400,000</b>		<b>\$8,200,000</b>	<b>\$6,400,000</b>	<b>\$3,900,000</b>
Health and Safety (10%)	\$940,000				
Bid Contingency (15%)	\$1,400,000				
Scope Contingency (20%)	\$1,900,000				
<b>CONSTRUCTION TOTAL</b>	<b>\$14,000,000</b>				
Permitting & Legal (5%)	\$700,000				
Services During Construction (8%)	\$1,100,000				
<b>TOTAL IMPLEMENTATION COST</b>	<b>\$16,000,000</b>				
Engineering & Design (10%)	\$1,600,000				
<b>TOTAL CAPITAL COSTS</b>	<b>\$18,000,000</b>				
<b>PRESENT WORTH</b>			<b>\$26,000,000</b>	<b>\$24,000,000</b>	<b>\$22,000,000</b>

\* Present worth calculated assuming replacement of 30% topsoil, regrading, and revegetating every 10 yrs.

Table 6-6

Cost Estimate Summary  
Alternative 5  
Incineration of Hotspot Soil

Item	Capital Cost	Annual O & M	Present Worth		
			O&M/Replacement 3%	30 Years 5%	10%
<b>I. GENERAL SITE PREPARATION</b>					
Decontamination Facility	\$14,000	\$4,500	\$21,000	\$19,000	\$17,000 *
Move Watson Residence	\$21,000				
Extend Site Boundary	\$20,000				
Extend Site Fence	\$20,000	\$1,000	\$20,000	\$15,000	\$9,400
Reroute S. Drainage Ditch	\$75,000				
Diversion Berm	\$30,000	\$5,000	\$23,000	\$22,000	\$19,000 *
Demolition of Site Structures	\$54,000				
Buildings for Incinerator	\$120,000				
Soil Storage Building	\$44,000				
<b>II. INCINERATION</b>					
Capital	\$1,300,000				
Maintenance		\$50,000	\$230,000	\$220,000	\$190,000 *
Operation		\$1,800,000	\$8,200,000	\$7,800,000	\$6,800,000 *
<b>III. EXCAVATION &amp; LOADING OF CONTAMINATED MATERIAL</b>					
Drum Excavation/Classification	\$580,000				
Soil Excavation	\$150,000				
Soil Handling and Loading	\$170,000				
Backfill Ash and Compact	\$140,000				
<b>IV. DOUBLE LINER SYSTEM</b>					
Clay Layer	\$170,000				
Drainage System	\$67,000				
HDPE Liner	\$130,000	\$3,000	\$59,000	\$46,000	\$28,000
Geotextile	\$46,000				
<b>V. MULTI-LAYER CAP</b>					
Clay Layer	\$670,000				
HDPE Liner	\$310,000	\$5,000	\$98,000	\$77,000	\$47,000
Drainage Layer	\$220,000				
Vegetative Soil Layer	\$580,000		\$250,000	\$180,000	\$86,000 **
Revegetation	\$20,000	\$1,000	\$55,000	\$40,000	\$21,000 **
<b>VI. GROUNDWATER</b>					
Slurry Wall	\$690,000				
Wells in Water Table Aquifer	\$1,200,000	\$180,000	\$3,500,000	\$2,800,000	\$1,700,000
Oil Skimmers	\$90,000				
Wells in Upper Intermediate Unit	\$82,000	\$15,000	\$290,000	\$230,000	\$140,000
5 Year Pump Replacement			\$810,000	\$610,000	\$340,000
<b>VII. WATER TREATMENT</b>					
Total System 50 GPM	\$250,000	\$87,000	\$1,700,000	\$1,300,000	\$820,000
<b>VIII. MONITORING</b>					
Onsite Laboratory	\$400,000	\$110,000	\$500,000	\$480,000	\$420,000 *
Runoff Monitoring		\$16,000	\$310,000	\$250,000	\$150,000
Groundwater Monitoring	\$32,000	\$54,000	\$1,100,000	\$830,000	\$510,000
<b>CONSTRUCTION SUBTOTAL</b>	<b>\$7,700,000</b>		<b>\$17,000,000</b>	<b>\$15,000,000</b>	<b>\$11,000,000</b>
Health and Safety (10%)	\$770,000				
Bid Contingency (15%)	\$1,200,000				
Scope Contingency (20%)	\$1,500,000				
<b>CONSTRUCTION TOTAL</b>	<b>\$11,000,000</b>				
Permitting & Legal (5%)	\$550,000				
Services During Construction (8%)	\$900,000				
<b>TOTAL IMPLEMENTATION COST</b>	<b>\$12,000,000</b>				
Engineering & Design (10%)	\$1,000,000 ***				
<b>TOTAL CAPITAL COSTS</b>	<b>\$13,000,000</b>				
<b>PRESENT WORTH</b>			<b>\$30,000,000</b>	<b>\$28,000,000</b>	<b>\$24,000,000</b>

\* Present worth calculated over 5 yr. treatment period.

\*\* Present worth calculated assuming replacement of 30% topsoil, regrading, and revegetating every 10 yrs.

\*\*\* Engineering and design costs do not include pre-engineered incineration unit.

Table 6-7

Cost Estimate Summary  
Alternative 6  
Incineration of Vadose Soil

Item	Capital Cost	Annual O & M	Present Worth O&M/Replacement		
			3%	5%	10%
<b>I. GENERAL SITE PREPARATION</b>					
Decontamination Facility	\$14,000	\$4,500	\$35,000	\$32,000	\$26,000 *
Move Watson Residence	\$21,000				
Extend Site Boundary	\$20,000				
Extend Site Fence	\$20,000	\$1,000	\$20,000	\$15,000	\$9,400
Reroute S. Drainage Ditch	\$75,000				
Diversion Berm	\$30,000	\$5,000	\$39,000	\$36,000	\$29,000 *
Demolition of Site Structures	\$54,000				
Buildings for Incinerator	\$120,000				
Soil Storage Building	\$44,000				
<b>II. INCINERATION</b>					
Capital	\$2,600,000				
Maintenance		\$100,000	\$800,000	\$700,000	\$580,000 *
Operation		\$3,500,000	\$27,000,000	\$25,000,000	\$20,000,000 *
<b>III. EXCAVATION &amp; LOADING OF CONTAMINATED MATERIAL</b>					
Drum Excavation/Classification	\$580,000				
Soil Excavation	\$580,000				
Soil Handling and Loading	\$920,000				
Backfill Ash and Compact	\$760,000				
<b>IV. DOUBLE LINER SYSTEM</b>					
Clay Layer	\$670,000				
Drainage System	\$260,000				
HDPE Liner	\$520,000	\$5,000	\$98,000	\$77,000	\$47,000
Geotextile	\$180,000				
<b>V. MULTI-LAYER CAP</b>					
Clay Layer	\$670,000				
HDPE Liner	\$310,000	\$5,000	\$98,000	\$77,000	\$47,000
Drainage Layer	\$220,000				
Vegetative Soil Layer	\$580,000		\$250,000	\$180,000	\$86,000 **
Revegetation	\$20,000	\$1,000	\$55,000	\$40,000	\$21,000 **
<b>VI. GROUNDWATER</b>					
Slurry Wall	\$690,000				
Wells in Water Table Aquifer	\$1,200,000	\$180,000	\$3,500,000	\$2,800,000	\$1,700,000
Oil Skimmers	\$90,000				
Wells in Upper Intermediate Unit	\$82,000	\$15,000	\$290,000	\$230,000	\$140,000
5 Year Pump Replacement			\$810,000	\$610,000	\$340,000
<b>VII. WATER TREATMENT</b>					
Total System 50 GPM	\$250,000	\$87,000	\$1,700,000	\$1,300,000	\$820,000
<b>VIII. MONITORING</b>					
Onsite Laboratory	\$400,000	\$110,000	\$860,000	\$780,000	\$630,000 *
Runoff Monitoring		\$16,000	\$310,000	\$250,000	\$150,000
Groundwater Monitoring	\$32,000	\$54,000	\$1,100,000	\$830,000	\$510,000
<b>CONSTRUCTION SUBTOTAL</b>	<b>\$12,000,000</b>		<b>\$37,000,000</b>	<b>\$33,000,000</b>	<b>\$25,000,000</b>
Health and Safety (10%)	\$1,200,000				
Bid Contingency (15%)	\$1,800,000				
Scope Contingency (20%)	\$2,400,000				
<b>CONSTRUCTION TOTAL</b>	<b>\$17,000,000</b>				
Permitting & Legal (5%)	\$850,000				
Services During Construction (8%)	\$1,400,000				
<b>TOTAL IMPLEMENTATION COST</b>	<b>\$19,000,000</b>				
Engineering & Design (10%)	\$1,500,000 ***				
<b>TOTAL CAPITAL COSTS</b>	<b>\$21,000,000</b>				
<b>PRESENT WORTH</b>			<b>\$58,000,000</b>	<b>\$54,000,000</b>	<b>\$46,000,000</b>

\* Present worth calculated over 9 yr. treatment period.

\*\* Present worth calculated assuming replacement of 30% topsoil, regrading, and revegetating every 10 yrs.

\*\*\* Engineering and design costs do not include pre-engineered incineration units.

Table 6-3

Cost Estimate Summary  
Alternative 7  
Incineration of All Unconsolidated Material

Item	Capital Cost	Annual O & M	Present Worth O&M/Replacement		
			3%	5%	10%
<b>I. GENERAL SITE PREPARATION</b>					
Decontamination Facility	\$14,000	\$4,500	\$45,000	\$40,000	\$31,000 *
Move Watson Residence	\$21,000				
Extend Site Boundary	\$20,000				
Extend Site Fence	\$20,000	\$1,000	\$20,000	\$15,000	\$9,000
Reroute S. Drainage Ditch	\$75,000				
Diversion Berm	\$30,000	\$5,000	\$50,000	\$44,000	\$34,000 *
Demolition of Site Structures	\$54,000				
Soil Storage Building	\$44,000				
<b>II. EXCAVATION &amp; BACKFILLING OF ALL UNCONSOLIDATED MATERIAL</b>					
Drum Excavation/Classification	\$580,000				
Soil Excavation	\$4,300,000				
Dewatering Excavation	\$500	\$1,000	\$10,000	\$9,000	\$7,000 *
Soil Handling and Loading	\$3,800,000				
Backfill Clean Material and Compact	\$2,600,000				
Backfill Treated Soil and Compact	\$3,100,000				
<b>III. INCINERATION</b>					
Capital	\$4,000,000				
Maintenance		\$200,000	\$2,000,000	\$1,800,000	\$1,400,000 *
Operation		\$11,680,000	\$120,000,000	\$100,000,000	\$80,000,000 *
<b>IV. DOUBLE LINER SYSTEM</b>					
Clay Layer	\$670,000				
Drainage System	\$260,000				
HDPE Liner	\$520,000	\$5,000	\$98,000	\$77,000	\$47,000
Geotextile	\$180,000				
<b>V. MULTI-LAYER CAP</b>					
Clay Layer	\$670,000				
HDPE Liner	\$310,000	\$5,000	\$98,000	\$77,000	\$47,000
Drainage Layer	\$220,000				
Vegetative Soil Layer	\$580,000		\$250,000	\$180,000	\$86,000 **
Revegetation	\$20,000	\$1,000	\$55,000	\$40,000	\$21,000 **
<b>VI. GROUNDWATER</b>					
Slurry Wall	\$690,000				
Drains in Water Table Aquifer	\$240,000	\$2,500	\$49,000	\$38,000	\$24,000
Wells in Upper Intermediate Unit	\$82,000	\$15,000	\$294,000	\$231,000	\$141,000
<b>VII. WATER TREATMENT</b>					
Total System 50 GPM	\$250,000	\$87,000	\$1,700,000	\$1,300,000	\$820,000
<b>VIII. MONITORING</b>					
Mobile Laboratory	\$400,000	\$110,000	\$1,100,000	\$1,000,000	\$750,000 *
Runoff Monitoring		\$16,000	\$310,000	\$250,000	\$150,000
Monitoring Wells	\$32,000	\$54,000	\$1,100,000	\$830,000	\$510,000
<b>CONSTRUCTION SUBTOTAL</b>	<b>\$24,000,000</b>		<b>\$127,000,000</b>	<b>\$106,000,000</b>	<b>\$84,000,000</b>
Health and Safety (10%)	\$2,400,000				
Bid Contingency (15%)	\$3,600,000				
Scope Contingency (20%)	\$4,800,000				
<b>CONSTRUCTION TOTAL</b>	<b>\$35,000,000</b>				
Permitting & Legal (5%)	\$1,800,000				
Services During Construction (8%)	\$2,800,000				
<b>TOTAL IMPLEMENTATION COST</b>	<b>\$40,000,000</b>				
Engineering & Design (10%)	\$3,300,000 ***				
<b>TOTAL CAPITAL COSTS</b>	<b>\$43,000,000</b>				
<b>PRESENT WORTH</b>			<b>\$170,000,000</b>	<b>\$149,000,000</b>	<b>\$127,000,000</b>

\* Present worth calculated over 12 yr. treatment period.

\*\* Present worth calculated assuming replacement of 30% topsoil, regrading, and revegetating every 10 yrs.

\*\*\* Engineering and design costs do not include pre-engineered incineration units.

Table 6-9

Cost Estimate Summary  
Alternative B  
In Situ Vittrification of Hotspot Soil

Item	Capital Cost	Annual O & M	Present Worth SLM/Replacement		
			3%	5%	10%
<b>I. GENERAL SITE PREPARATION</b>					
Decontamination Facility	\$14,000	\$4,500	\$9,000	\$8,000	\$8,000 †
Move Watson Residence	\$21,000				
Extend Site Boundary	\$20,000				
Extend Site Fence	\$20,000	\$1,000	\$20,000	\$15,000	\$9,000
Reroute S. Drainage Ditch	\$75,000				
Diversion Bern	\$30,000	\$5,200	\$10,000	\$9,000	\$9,000 †
Demolition of Site Structures	\$54,000				
Removal & Incineration of Drums & Tanks	\$1,300,000				
<b>II. IN SITU VITRIFICATION</b>					
Capital	\$2,200,000				
Operation and Maintenance		\$4,700,000	\$9,000,000	\$8,700,000	\$8,200,000 †
<b>III. BACKFILL AND CAP ENTIRE SITE</b>					
Backfill Subsid Areas with Clean Fill	\$86,000				
Clay Layer	\$670,000				
HDPE Liner	\$310,000	\$5,000	\$98,000	\$77,000 †	\$47,000
Drainage Layer	\$220,000				
Vegetative Soil Layer	\$580,000		\$250,000	\$180,000	\$86,000 ††
Revegetation	\$20,000	\$1,000	\$55,000	\$40,000	\$21,000 ††
<b>IV. GROUNDWATER</b>					
Slurry Wall	\$690,000				
Wells in Water Table Aquifer	\$1,200,000	\$180,000	\$3,500,000	\$2,800,000	\$1,700,000
Oil Skimmers	\$90,000				
Wells in Upper Intermediate Unit	\$82,000	\$15,000	\$290,000	\$230,000	\$140,000
5 Year Pump Replacement			\$810,000	\$610,000	\$340,000
<b>VI. WATER TREATMENT</b>					
Total System 50 GPM	\$250,000	\$87,000	\$1,700,000	\$1,300,000	\$820,000
<b>VII. MONITORING</b>					
Mobile Laboratory	\$400,000	\$110,000	\$210,000	\$200,000	\$190,000 †
Runoff Monitoring		\$16,000	\$310,000	\$250,000	\$150,000
Monitoring Wells	\$32,000	\$54,000	\$1,100,000	\$830,000	\$510,000
<b>CONSTRUCTION SUBTOTAL</b>	<b>\$8,000,000</b>		<b>\$17,000,000</b>	<b>\$15,000,000</b>	<b>\$12,000,000</b>
Health and Safety (10%)	\$800,000				
Bid Contingency (15%)	\$1,220,000				
Scope Contingency (20%)	\$1,600,000				
<b>CONSTRUCTION TOTAL</b>	<b>\$12,000,000</b>				
Permitting & Legal (5%)	\$600,000				
Services During Construction (8%)	\$1,000,000				
<b>TOTAL IMPLEMENTATION COST</b>	<b>\$14,000,000</b>				
Engineering & Design (10%)	\$1,400,000				
<b>TOTAL CAPITAL COSTS</b>	<b>\$15,000,000</b>				
<b>PRESENT WORTH</b>			<b>\$32,000,000</b>	<b>\$30,000,000</b>	<b>\$27,000,000</b>

† Present worth calculated over 2 yr. treatment period.

†† Present worth calculated assuming replacement of 30% topsoil, regrading, and revegetating every 10 yrs.

Table 6-10

Cost Estimate Summary  
Alternative 9  
In Situ Vitrification of Vadose Soil

Item	Capital Cost	Annual O & M	Present Worth O&M/Replacement		
			3%	5%	12%
I. GENERAL SITE PREPARATION					
Decontamination Facility	\$14,000	\$4,500	\$24,000	\$23,000	\$20,000 †
Move Watson Residence	\$21,000				
Extend Site Boundary	\$20,000				
Extend Site Fence	\$20,000	\$1,000	\$20,000	\$15,000	\$9,000
Reroute S. Drainage Ditch	\$75,000				
Diversion Bern	\$30,000	\$5,000	\$27,000	\$25,000	\$22,000 †
Demolition of Site Structures	\$54,000				
Rough Grade Site Prior to ISV	\$14,000				
Removal & Incineration of Drums & Tanks	\$1,300,000				
II. IN SITU VITRIFICATION					
Capital	\$2,200,000				
Operation and Maintenance		\$5,200,000	\$28,000,000	\$26,000,000	\$23,000,000 †
III. SOIL COVER AND REVEGETATE					
Cover with Topsoil	\$380,200				
Revegetation	\$20,000	\$1,000	\$20,000	\$15,000	\$9,000
IV. GROUNDWATER					
Slurry Wall	\$690,000				
Wells in Water Table Aquifer	\$1,200,000	\$180,000	\$3,500,000	\$2,800,000	\$1,700,000
Oil Skimmers	\$90,000				
Wells in Upper Intermediate Unit	\$82,000	\$15,000	\$290,000	\$230,000	\$140,000
5 Year Pump Replacement			\$810,000	\$610,000	\$340,000
VI. WATER TREATMENT					
Total System 50 GPM	\$250,000	\$87,000	\$1,700,000	\$1,300,000	\$820,000
VII. MONITORING					
Mobile Laboratory	\$400,000	\$110,000	\$600,000	\$560,000	\$480,000 †
Runoff Monitoring		\$16,000	\$310,000	\$250,000	\$150,000
Monitoring Wells	\$32,000	\$54,000	\$1,100,000	\$830,000	\$510,000
CONSTRUCTION SUBTOTAL	\$7,000,000		\$36,000,000	\$33,000,000	\$27,000,000
Health and Safety (10%)	\$700,000				
Bid Contingency (15%)	\$1,100,000				
Scope Contingency (20%)	\$1,400,000				
CONSTRUCTION TOTAL	\$10,000,000				
Permitting & Legal (5%)	\$500,000				
Services During Construction (8%)	\$800,000				
TOTAL IMPLEMENTATION COST	\$11,000,000				
Engineering & Design (10%)	\$1,100,000				
TOTAL CAPITAL COSTS	\$12,000,000				
PRESENT WORTH			\$48,000,000	\$45,000,000	\$39,000,000

† Present worth calculated over 6 yr. treatment period.

Because this feasibility study is conceptual and based on data available at the time, bid and scope contingencies were estimated to account for unknown costs. Bid contingencies account for a variety of factors that would tend to increase costs associated with constructing a given project scope, such as economic/bidding climate, contractors inexperienced in working on hazardous waste sites, contractors' uncertainty regarding liability and insurance on hazardous waste site, adverse weather conditions, strikes by material suppliers, and geotechnical unknowns. Scope contingencies cover changes which invariably occur during final design and implementation. Scope contingencies include provisions for items such as inherent uncertainties in defining waste volumes and regulatory or policy changes that may affect FS assumptions. Allowances for price inflation and abnormal technical difficulties are not accounted for in the contingencies.

Present worth was determined over a 30-year period to allow for comparison of costs over that period. It should be noted that costs will continue to accrue where operation and maintenance is required after the 30-year period; however, the present-worth analysis does not reflect these additional costs. As per U.S. EPA guidance, no cost expenditures in the future are escalated to reflect inflation. Three, five and ten percent discount rates are applied to future values in computing present worth.

Health and safety requirements are estimated to include Levels B, C and D personal protective equipment. During construction, vehicle decontamination would be required for all vehicles having direct contact with contaminated soil and landfill wastes. During final demobilization of equipment, the vehicles and hand equipment used onsite would be steam-cleaned. Workers who would be exposed to the contaminated soil during onsite activities would receive physical examinations before and after all phases of activity involving direct worker exposure to contaminated elements of the site. These elements of health and safety measures are covered in a supervision/health and safety contingency designed to include costs incurred for work on hazardous waste sites above and beyond those incurred on traditional construction jobs.



Cost Sensitivity Analysis: Costs presented in this section represent order-of-magnitude estimates assembled from information available at the time of the estimate. To develop useful cost estimates for feasibility assessment, it was necessary to make reasonable assumptions regarding labor and material costs, site conditions, etc. If actual conditions vary substantially from the estimates made, the cost of an alternative may be outside the order-of-magnitude range presented here. Factors such as deviations in estimated labor and material costs are not considered significant to the extent of altering total costs to values outside the order-of-magnitude range.

The two primary factors which may substantially influence the cost estimates are aquifer characteristics (variations in groundwater discharge) and buried drum quantities. The complex hydrogeology of the site and the lack of pump test data make accurate prediction of discharge from the groundwater collection system difficult. Increased discharge would escalate water treatment costs, while decreased discharge would lower these costs. However, since the same groundwater collection and treatment system is specified for Alternatives 3 through 9, altering of groundwater discharge will not affect these alternative costs relative to one another. Similarly, a variation in the number of buried drums onsite will raise or lower overall implementation costs of Alternatives 3 through 9, but will not alter the relative status of these alternative costs. The difference in costs between Alternative 2 and Alternatives 3 through 9 is great enough that, even with relatively large sensitivities, Alternative 2 will retain its significantly lower relative cost.

The extent of soil contamination is well defined, based on testing performed during the Remedial Investigation. Although differences between the actual and estimated extent of contamination would affect alternative costs relative to one another, these differences should be small enough to be negligible.

The one factor which may have a significant effect on the relative cost of an alternative is the state of development of in situ treatment. While capping, RCRA landfill construction and incineration are proven technologies, large-scale in situ treatment of soil is a relatively new process. The cost of implementing in situ treatment on a site of this size may be more variable than for technologies with a greater range of prior application.

All alternatives exhibit limited economic sensitivity, with the exception of Alternatives 8 and 9. Although actual implementation costs of the alternatives may vary, the relative costs of the alternatives should remain the same. When selecting the final remedial alternative, variable factors need only be considered for Alternatives 8 and 9.

#### 6.4 SUMMARY OF DETAILED ANALYSIS OF ALTERNATIVES

A summary of the detailed analysis of alternatives is presented in Figure 6-1. The range of alternatives provides differing degrees of effectiveness and implementability at various costs. The No Action alternative offers no protection of public health and the environment, nor reduction of toxicity, mobility or volume (TMV) of contaminants. Alternative 2 provides minimal protection by mitigating the existing health risks to the Watson family. Alternative 2 relies heavily on monitoring for protection of public health and, like Alternative 1, does not reduce TMV. The only positive aspects of Alternative 2 are its low cost and its reliance on readily available and technically feasible technologies.

Alternatives 3 through 9 incorporate containment and treatment of contaminated groundwater. The vertical barrier and pumping of the Water Table Aquifer would reduce contamination in that aquifer and also stagnate the contaminant plume in the Upper Intermediate Unit. Additional protectiveness and reliability is provided by extraction of contaminated groundwater from the Upper Intermediate Unit. As contamination from the Upper Intermediate Unit is removed, it may eventually lead to aquifer restoration and cessation of pumping.

The removal and incineration of subsurface waste (buried drums and tanks) in Alternatives 3 through 9 eliminates a major known existing onsite contaminant source. This provides a significant reduction in TMV and increased protection of public health and the environment by preventing future releases. The subsurface waste will be destroyed, thus complying with the intent of SARA.

The largest variation in alternatives is in dealing with contaminated soil and sediment. Alternatives 3 and 4 provide containment of contaminated soil and sediment. The containment provided in Alternative 4 is more reliable as it incorporates a double liner system to prevent leachate migration, while Alternative 3 only offers a multi-layer cap to reduce infiltration. However, Alternative 4 is more costly and requires excavation and placement of untreated material in a landfill which does not fully satisfy the intent of SARA.

	ASSEMBLED ALTERNATIVE	ASSEMBLED ALTERNATIVE	ASSEMBLED ALTERNATIVE	ASSEMBLED ALTERNATIVE	ASSEMBLED ALTERNATIVE	ASSEMBLED ALTERNATIVE	ASSEMBLED ALTERNATIVE	ASSEMBLED ALTERNATIVE	ASSEMBLED ALTERNATIVE
	1	2	3	4	5	6	7	8	9
<b>EFFECTIVENESS CRITERIA</b>									
Protectiveness	--	0	+	+	+	+	++	+	+
Reliability	-	0	+	+	++	++	++	++	++
ARARs	-	-	+	+	+	+	+	+	+
Reduction in toxicity, mobility, or volume (TMV)	--	--	0	+	+	+	++	+	++
<b>IMPLEMENTABILITY CRITERIA</b>									
Technical Feasibility	NA	+	+	+	+	+	-	+	+
Availability	NA	+	++	++	0	-	--	-	-
Administrative Feasibility	--	-	0	+	+	0	-	+	+
<b>ORDER OF MAGNITUDE <sup>a</sup> COST ESTIMATES</b>									
Total Capital <sup>b</sup>	\$0	\$150,000	\$11,000,000	\$18,000,000	\$13,000,000	\$21,000,000	\$43,000,000	\$15,000,000	\$12,000,000
Present Worth <sup>c</sup>	\$0	\$820,000	\$15,000,000	\$22,000,000	\$24,000,000	\$46,000,000	\$127,000,000	\$27,000,000	\$39,000,000

#### NOTES:

- <sup>a</sup> The American Association of Cost Engineers defines an Order-of-Magnitude Estimate as an approximate estimate made without detailed engineering data. It is normally expected that an estimate of this type is accurate within +50% to -30%. Sources of cost information include the U.S. EPA's "Compendium of Cost of Remedial Technologies at Hazardous Waste Sites," the Means Site Work Cost Data guide, Cost Reference Guide for Construction Equipment and vendor estimates.
- <sup>b</sup> Total Capital Cost includes indirect cost for engineering services, legal fees, administration costs and cost contingencies. Refer to Tables 6-3 through 6-10 for a summary of the cost estimate for each alternative.
- <sup>c</sup> Total Present Worth Cost is based on 30-year period and 10 percent interest.

#### LEGEND:

- EXTREMELY NEGATIVE EFFECTS; EVEN WITH MITIGATING MEASURES CAPABLE OF ELIMINATING AN ALTERNATIVE
- NEGATIVE EFFECTS BUT NOT STRONG ENOUGH TO BE THE SOLE JUSTIFICATION FOR ELIMINATING AN ALTERNATIVE OR OF ONLY MODERATE SIGNIFICANCE
- 0 OF VERY LITTLE APPARENT POSITIVE OR NEGATIVE EFFECTS, BUT INCLUSION CAN BE JUSTIFIED FOR SOME SPECIAL REASON OR NO CHANGE FROM EXISTING CONDITIONS
- +
- ++ AN EXTREMELY POSITIVE BENEFIT
- \* ANALYSIS NOT COMPLETE OR INAPPROPRIATE TO DRAW CONCLUSIONS AT THIS TIME
- NA NOT APPLICABLE

FIGURE 6-1  
SUMMARY OF DETAILED  
ANALYSIS OF ALTERNATIVES  
SUMMIT NATIONAL FS

Alternatives 5 through 9 include soil treatment. The greatest reduction in TMV is achieved in Alternative 7, followed by Alternatives 6 and 9, then Alternatives 5 and 8. Alternatives 5, 6 and 7 are more reliable than Alternatives 8 and 9 as they utilize incineration, which is a well demonstrated technology. Alternatives 8 and 9 provide the additional benefit of encapsulating inorganic contaminants, although they are not contaminants of major concern at this site. The proposed in situ vitrification for soil treatment is not in common use; thus, uncertainties in performance are inherent. In assessing all the alternatives, two alternatives compare similarly for most of the evaluation criteria. The alternatives are Alternative 5 - Thermal Treatment of "Hot Spot" Soils and Alternative 8 - In Situ Vitrification of "Hot Spot" Soils. The principal difference is incineration versus in-situ vitrification. These two technologies are different but comparable based on protectiveness, meeting ARARs and technical feasibility. While in-situ vitrification is promising, there is some uncertainty whether in-situ vitrification is a reliable technology since it is still in it's developmental stage.

Another criteria that has not been evaluated is State and community acceptance which fall under the administrative feasibility criteria. The State and community acceptance can only be evaluated after their concerns with the Feasibility Study have been identified during the public comment period. Following the public comment period, U. S. EPA will respond to these comments and determine the final selection of the remedial alternative for the Summit National site.

In the meantime, U. S. EPA feels comfortable recommending Alternative 5 - Thermal Treatment of "Hot Spot" Soils. Incineration is a proven technology that meets the effectiveness and implementability criteria, and is cost effective.



## CHAPTER 7

### RECOMMENDED ALTERNATIVE

This chapter presents the recommended alternative for the Summit National site. The NCP [Section 300.68(i)] requires U.S. EPA to select an alternative that meets the following criteria:

- o The alternative shall be protective of human health and the environment. In the absence of Federal or State standards, protectiveness will be based on health levels through a risk assessment.
- o The alternative shall attain applicable, or relevant and appropriate Federal and State public health and environmental requirements.
- o The alternative shall be cost-effective, accomplishing a level of protection that cannot be achieved by other less costly methods.
- o The alternative will use treatment technologies and permanent solutions to the maximum extent practicable as determined by technical feasibility, availability and cost effectiveness.

The preferred remedy will reflect the best balance across all evaluation criteria. This section will compare the assembled alternatives presented in Section 6 and will recommend the preferred alternative for the site. Figure 6-1 presented a summary of the detailed analysis of the alternatives for the Summit National Site.

#### 7.1 ASSEMBLED ALTERNATIVE COMPARISON

##### ALTERNATIVE NO. 1

The no action alternative is ineffective in protecting public health and the environment. The PHE concluded that there is a potential for exposure to contaminants at the site that could adversely affect public health, welfare, and the environment. Therefore, the no action alternative is not appropriate and does not meet the goals of the NCP. The alternative was not carried throughout the comparison.

## ALTERNATIVE NO. 2

This alternative reduces the exposure of the public to onsite contaminants through access and deed restrictions. However, this alternative does not prevent contaminant migration and does not reduce concentrations of existing contamination at the site. The site would continue to pose a threat to public health, welfare, and the environment. Therefore, this alternative was not carried forward for selection.

## ALTERNATIVES NOS. 3 AND 4

These alternatives are similar in that both include the removal and offsite incineration of buried tanks and drums, removal of onsite structures, onsite surface water elimination, installation of vertical barriers and groundwater extraction wells, groundwater and runoff monitoring, a multi-layer cap, water treatment, and relocation of the Watson residence. Alternative 3 would place a cap over contaminated materials without first placing them within a liner. Under the Ohio Solid Waste Act, an unlined landfill cannot be located within 1000 feet of drinking water wells. Therefore, Alternative 3 could not be implemented without providing an alternate drinking water supply to residents within 1000 feet of the site. This is an additional cost item not included in this alternative.

Alternative 4 differs from Alternative 3 in that contaminated vadose zone materials will be placed in a double liner system satisfying the requirements of RCRA. The placement of materials in this liner involves additional handling of the vadose zone soils to allow liner construction. The alternate drinking water supply requirement does not apply to Alternative 4. The double liner system will prevent contamination from leaching into groundwater and therefore provides more protection than Alternative 3. However, site constraints make Alternative 4 difficult to implement. Additionally, it will have high capital, operation, and maintenance costs.

Neither of these alternatives include treatment of the contaminated soils which results in contaminant sources remaining onsite. These contaminants can possibly degrade the double liner system and therefore would not provide adequate protection of the environment. In addition, the transportation of buried drums to an offsite incinerator increases the risk of exposure to

the local population. Another disadvantage is the limited capacity of an offsite RCRA treatment facility to incinerate the contents of the drums and tanks. Therefore, Alternatives 3 and 4 were not carried forward for selection.

#### ALTERNATIVES NOS. 5, 6, AND 7

These three alternatives include the same scope of work as in Alternative 4, and in addition include the onsite incineration of contaminated soils, sediments and buried drum and tank contents. The alternatives differ in the amount of soil to be incinerated.

Alternative 5 includes the incineration of the hot spot soils which consist of approximately 27,000 cubic yards of highly contaminated soils. This treatment alternative removes the organic contaminant fraction, but does not treat the inorganics which would remain in the ash. However, the inorganic compounds do not pose a risk since the disposal of ash in a RCRA landfill is considered a technically effective means of controlling wastes. This alternative provides adequate protection to public health and the environment with a more cost effective approach than Alternatives 3 and 4. The risk associated with the remaining contamination is  $3 \times 10^{-5}$  under the maximum exposure scenario. However, this risk could only occur only if the cap failed and exposure to subsurface materials occurred. Alternative 5 will be retained for the recommended alternative comparison.

Alternative 6 requires the handling and incineration of the vadose zone soils which include approximately 105,000 cubic yards of material. This includes 100 percent of the unsaturated contaminated soils onsite. However, this alternative is technically difficult to implement and exposes the population to a lengthy operation of about 9 years during implementation. This alternative does not provide a significant improvements environmental benefit compared to Alternative 5. Therefore, Alternative 6 will not be carried forward.

Alternative 7 involves the handling and incineration of all unconsolidated material consisting of approximately 430,000 cubic yards. This alternative extends the removal zone beyond the contaminated vadose zone to include all subsurface material to the top of bedrock. Since this alternative requires excavation to bedrock, significant costs are associated with dewatering the



aquifers on site. Alternative 7 is the most costly. In addition, this alternative would be extremely difficult to implement due to the large volume of material to be handled, and exposes the population to a very lengthy operation of 12 years. Therefore, Alternative 7 was not retained for the recommended alternative comparison for this site.

#### ALTERNATIVE NOS. 8 AND 9

Alternatives 8 and 9 are similar to Alternative 3 with the exception that the soils will be vitrified in place rather than incinerated. Alternative 8 will use a RCRA cap over the entire site while Alternative 9 will use a soil cover only after vitrification is complete. Alternative 8 will treat the same hot spot soils as described in Alternative 5, consisting of approximately 27,000 cu. yds. of highly contaminated soil. The risk associated with the remaining contaminated cells are the same as presented in Alternative 5. This alternative will be retained for further comparison.

Alternative 9 will treat the contaminated vadose zone consisting of approximately 105,000 cubic yards. This alternative does not provide a significantly environmental benefit for its increased cost when compared to Alternative 8. Therefore, this alternative was not retained for the recommended alternative.

#### 7.2 GROUNDWATER RESPONSE

Alternatives 3 through 9 incorporate treatment of contaminated groundwater extracted from the Water Table Aquifer and the Upper Intermediate Unit. The vertical barrier and pumping of the contaminated groundwater in both aquifers would lead to aquifer restoration and cessation of pumping in the Intermediate Unit in 5 to 10 years. Pumping of the Water Table Aquifer will have to be performed for a much longer period of time since the groundwater response reduces the water available for flushing the contaminants to a very small volume.

The treatment process presented in Chapter 4 will meet water quality standards and effectively protect public health and the environment. Therefore, the U.S. EPA recommends that this groundwater response action be included in the recommended alternative.

### 7.3 ALTERNATIVES RETAINED FOR THE PREFERRED ALTERNATIVE

The alternatives that remain for further comparison are Alternative 5, Thermal Treatment of Hot Spot Soil, and Alternative 8, In Situ Vitrification of Hot Spot Soil. These two alternatives are described in detail in Chapter 5.

The selected remedy should represent the best balance across protectiveness, reliability, attainment of ARARs, implementability and cost factors. It is U.S. EPA's policy to select a remedy that significantly reduces toxicity, mobility, and volume of hazardous constituents and minimizes long term management. In making this selection the weaknesses and strengths of each alternative are discussed.

The principal element of difference between the alternatives for comparison is thermal treatment of soils versus in situ vitrification of the same soils. These alternatives are very similar when compared in terms of the degree of protectiveness, attainment of ARARs, reduction in toxicity, mobility, and volume, and technical feasibility.

Incineration satisfies the reduction in toxicity, mobility, and volume by destroying organics. The proposed landfill in Alternative 5 will contain the inorganics remaining in the ash, which would satisfy reduction in mobility. In-situ vitrification drives off volatiles that need to and will be treated and satisfies reduction in toxicity, mobility and volume by encapsulating the residual contaminants, thus immobilizing organic and inorganic compounds.

In-situ vitrification is a technology in its developmental stage and therefore it is uncertain whether it is a reliable technology. Incineration is a proven technology and its past performance proves it to be more reliable than vitrification.

Another consideration is the duration of time for implementing each alternative. Alternative 5 can be conducted within a 5 year period. Alternative 8 can range between 3 to 6 years because of the limited number of vitrification units available. Availability of the vitrification units for remediation at this time is uncertain. Contrary to vitrification, availability of mobile incineration does not appear to be a problem.

The final criteria to evaluate alternatives is the Administrative Feasibility. This criteria can be adequately assessed pending the State and community acceptance. Following the public comment period, all concerns will be addressed and the final remedial alternative will be selected for the Summit National site.

Until then, U.S. EPA recommends Alternative 5 - Thermal Treatment for "Hot Spot" Soils as the alternative that best meets effectiveness, implementability, and cost criteria.

#### 7.4 PREFERRED ASSEMBLED ALTERNATIVE

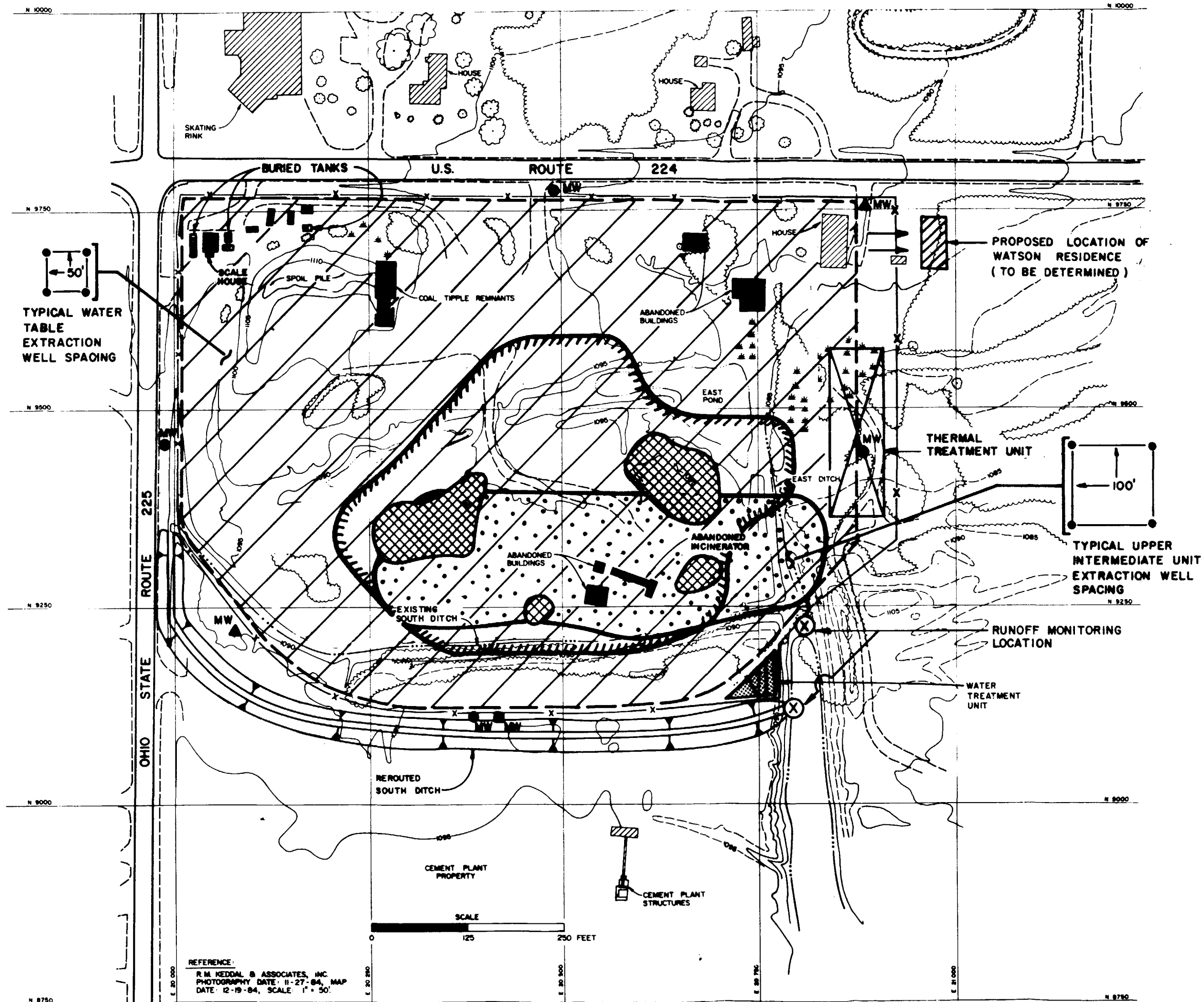
In assessing alternatives for remedial action, the preferred alternative for Summit National site is Alternative #5. This alternative provides adequate protection to public health and environment and significantly reduces the volume, toxicity, and mobility of contaminants. This alternative utilizes treatment technologies, permanent solutions to the maximum extent practicable, and is cost-effective.

#### 7.5 DESCRIPTION OF THE PREFERRED ALTERNATIVE

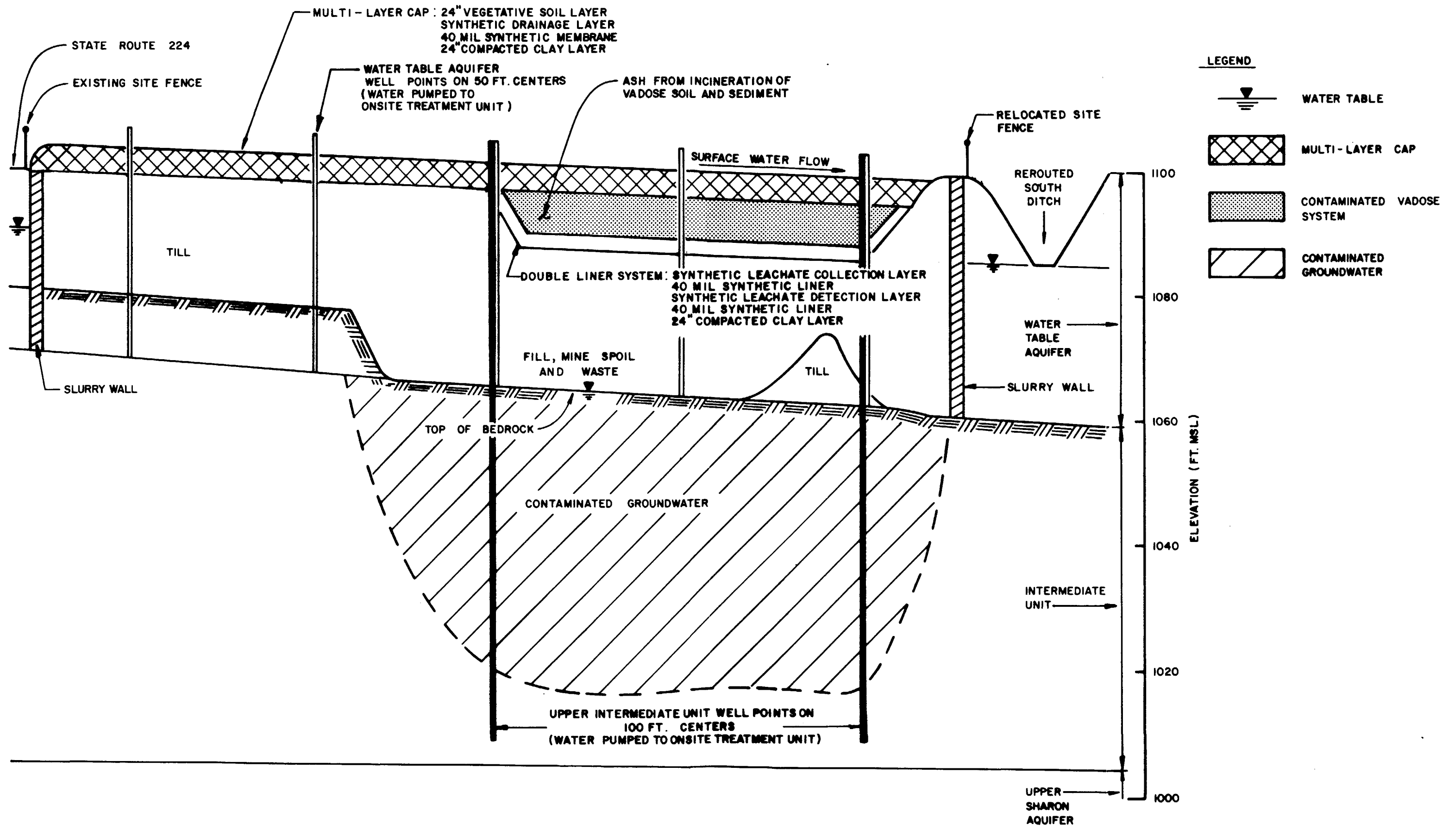
This alternative includes the following:

- o Access/Deed Restrictions
- o Runoff Monitoring
- o Groundwater Monitoring
- o Removal of Onsite Structures
- o Excavation and Incineration of Drums and Tanks, "Hot Spot" Soils, and Sediments
- o Multi-layer Cap
- o Vertical Barrier and Groundwater Extraction Wells
- o Elimination of Onsite Surface Water
- o Water Treatment
- o Relocation of Watson Residence

This alternative will remove a major source of contamination which includes the removal of approximately 1600 buried drums and four tanks. These wastes will be incinerated on site using a mobile incinerator. Another major source of contamination is the "hot spot" soils which will also be incinerated on site. The risk associated with soils will be greatly reduced. This alternative will take about five years to achieve. A plan view and cross section of the components of this alternative are presented on Figures 7-1 and 7-2.



REFERENCE:  
R.M. KEDDAL & ASSOCIATES, INC.  
PHOTOGRAPHY DATE: 11-27-84, MAP  
DATE: 12-19-84, SCALE: 1" = 50'



**FIGURE 7-2**  
**ALTERNATIVE 5 - THERMAL**  
**TREATMENT OF "HOT SPOT" SOIL**  
**GENERALIZED NORTH-SOUTH**  
**CROSS SECTION**  
**SUMMIT NATIONAL FS**

The groundwater cleanup will consist of treating groundwater from the Water Table Aquifer, Upper Intermediate Unit, and surface water. The cleanup goal is to meet water quality standards. In the absence of ARARs, the cleanup goal is the attainment of a  $10^{-6}$  carcinogenic risk level for site contaminants. The time required for groundwater cleanup of the Intermediate Unit is estimated to be about 5 to 10 years while the cleanup of the Water Table Aquifer will be more than 30 years.

This alternative provides containment of treated wastes and soils which protects public health and the environment from any type of residual contaminant migration. The untreated soils have an upperbound lifetime cancer risk of  $3 \times 10^{-5}$  can only occur if the cap fails and exposure to the sub-surface materials becomes a complete exposure pathway. The option includes onsite RCRA landfill, multi-layer cap, and vertical barriers. Runoff and groundwater monitoring will evaluate the efficiency of the containment and will indicate if any further action is warranted.

This alternative complies with applicable or relevant, and appropriate Federal and State requirements identified for the site. Technical implementability can be achieved without difficulty since equipment necessary is generally available including the mobile incinerators. This alternative has a capital cost of \$13,000,000 and an annual operation and total Present Worth Cost including O&M is about \$24,000,000.

In conclusion, Alternative 5 is recommended as the preferred alternative for remedial action at the Summit National Site in Deerfield, Ohio.



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## Appendix A

## APPENDIX A

### SOIL UNIT DIFFERENTIATION FOR ALTERNATIVE DEVELOPMENT

#### BACKGROUND

One of the major goals of this Feasibility Study is to evaluate a wide range of site specific remedial alternatives. The implementation of these alternatives should result in the provision of a range of levels of protection, as indicated in various FS guidance documents.

With respect to the soil contamination problem at the Summit National Site, it is apparent that the varying levels of protection that can be achieved range from no protection for the No Action Alternative, to maximum protection which occurs in a total soil removal/remediation alternative. The level of protection achieved by a given soil removal alternative is not directly proportional to the volume of soil removed. This is due to the heterogeneous distribution of contaminants, and the variation in health risks posed by these different contaminant concentrations.

During the RI, data was collected to characterize 100 ft. square areas (blocks) of soil at 2 ft. thick intervals. For use in this FS, the cancer risks posed by these soil blocks were estimated for the blocks for which chemical analysis data was available.

The purpose of this analysis was to allow quantification of the cancer risks caused by these soil blocks. This would in turn permit a rationale analysis to be made of the level of protection that could be achieved for a given soil removal scenario. Furthermore, it would identify which blocks posed the greatest cancer risks, allowing an increased level of protection to be attained by the removal of these blocks.

#### ESTIMATION OF CANCER RISKS

The cancer risks that were associated with soil blocks were estimated by comparing the concentrations of the indicator chemicals present in a soil block to those representing a range of lifetime upperbound cancer risks, as indicated in Table 3-2 of this report. A cancer risk was then extrapolated for the concentration present in the soil block. The cancer risks for each individual indicator chemical were then summed arithmetically to develop a total upperbound lifetime cancer risk for the soil block being analyzed.

Figures A-1 through A-4 present the total upperbound lifetime cancer risks for the soil blocks. Soil blocks measure 100 ft. by 100 ft. in plan, and are 2 ft.

thick. The maximum depth at which a soil block presents a risk is the maximum depth at which contamination was detected.

Figures A-5 through A-7 present the maximum depth at which a specified upperfound lifetime cancer risk (for example,  $10^{-5}$ ) was observed in a given 100 ft. by 100 ft. block of soil. These figures can be used to estimate the extent of soil removal that must be performed to remove soil blocks that result in a cancer risk exceeding a selected value.

#### SOIL REMOVAL SCENARIOS

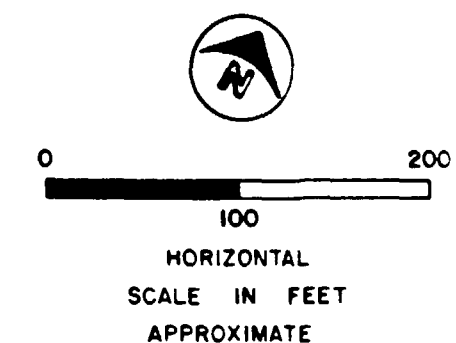
For this FS, a number of soil removal scenarios were developed and evaluated to present a range of protectiveness. The following section presents a discussion of the rationale for the selection and analysis of the various soil removal scenarios evaluated.

1. Hot Spot Soil Removal Scenario: A hot spot removal scenario was selected to permit evaluation of an alternative that provided an increased level of protection (over no action) by removal of a limited soil volume. The hot spot scenario includes the excavation of soils located in the southern portion of the site, primarily south of the onsite ponds as shown on Figure A-8. The selection of the soil blocks to excavate as part of the hot spot soil removal scenario evaluated in the FS (27,000 cu. yds. of contaminated soil) were made based on the following considerations:
  - a. Historical and RI Sampling Data: The portion of the Summit National Site south of the ponds was the area where the majority of waste disposal and related activities occurred. The concrete block pit, incineration unit, and four separate zones of buried drums are all located in this area. Additionally, RI sampling data indicated that the concentration of groundwater contamination in both the Water Table Aquifer and Upper Intermediate Unit is greatest in this area. These facts indicate the majority of remaining contaminant sources are probably located in this area.



**LEGEND**  
 ND NONE DETECTABLE  
 NT NOT TESTED  
 $1 \times 10^{-6}$  UPPERBOUND LIFETIME  
 CANCER RISK

NOTE : RISKS BASED ON DATA PRESENTED IN  
 TABLE 3-2 OF THE FS, SOIL SAMPLING  
 DATA CONTAINED IN THE RI, AND ON  
 DATA CONTAINED IN THE PHE.



**FIGURE A - 1**  
 UPPERBOUND LIFETIME  
 CANCER RISKS IN SOIL  
 DEPTH: 0-2 FT.  
 SUMMIT NATIONAL FS



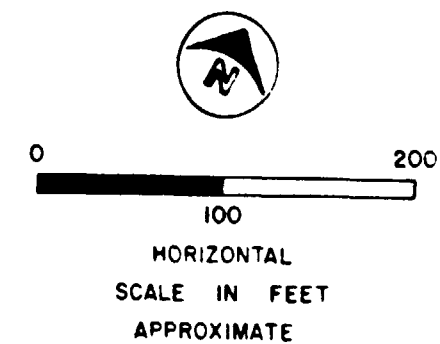
**LEGEND**

ND NONE DETECTABLE

NT NOT TESTED

$1 \times 10^{-6}$  UPPERBOUND LIFETIME CANCER RISK

NOTE : RISKS BASED ON DATA PRESENTED IN TABLE 3-2 OF THE FS, SOIL SAMPLING DATA CONTAINED IN THE RI, AND ON DATA CONTAINED IN THE PHE.

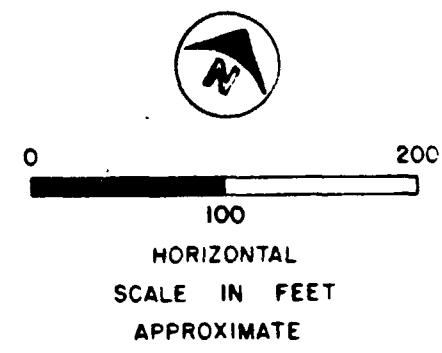


**FIGURE A - 2**  
**UPPERBOUND LIFETIME**  
**CANCER RISKS IN SOIL**  
 DEPTH: 2-4 FT.  
 SUMMIT NATIONAL FS

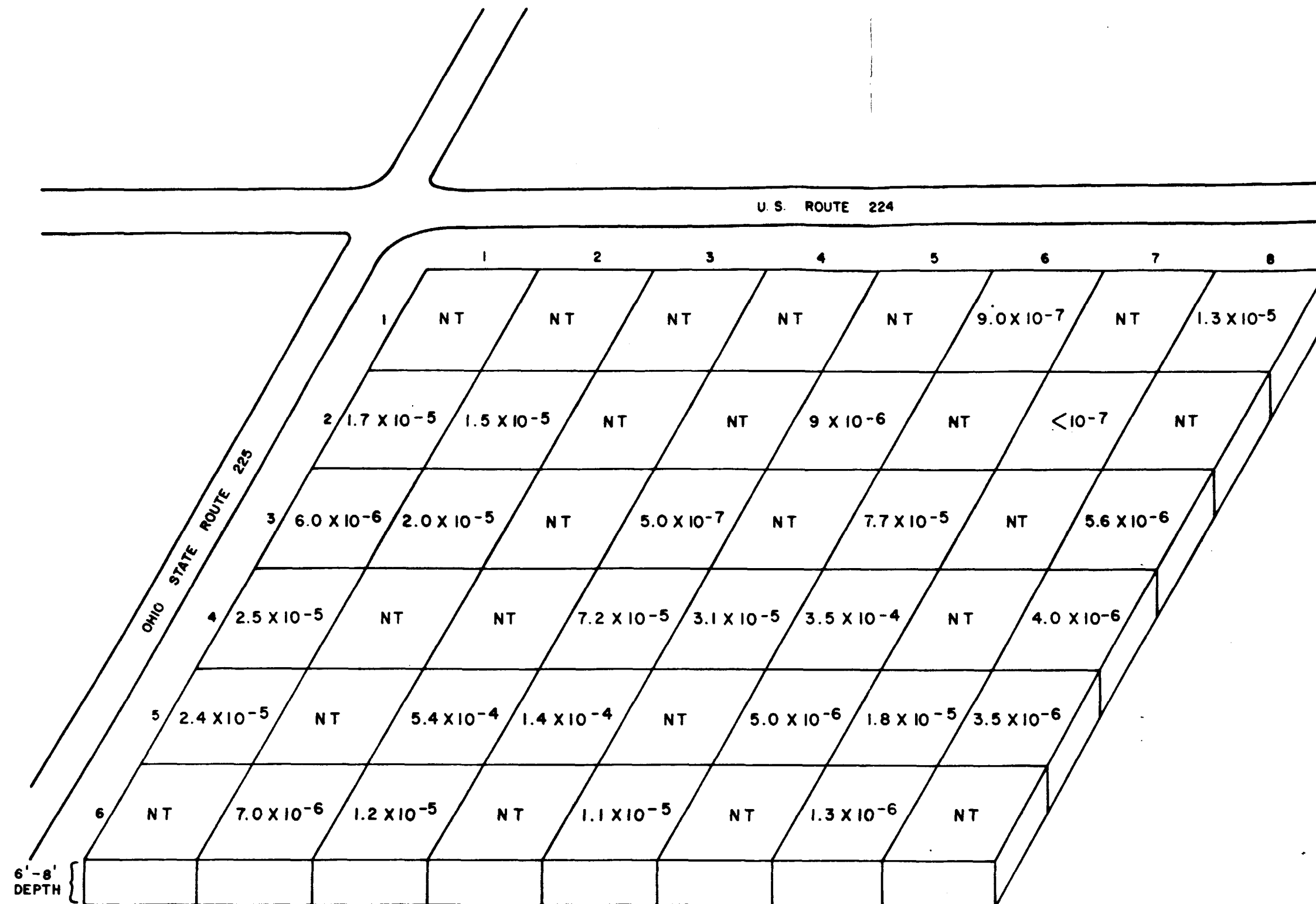


**LEGEND**  
 ND NONE DETECTABLE  
 NT NOT TESTED  
 $1 \times 10^{-6}$  UPPERBOUND LIFETIME  
 CANCER RISK

NOTE : RISKS BASED ON DATA PRESENTED IN  
 TABLE 3-2 OF THE FS, SOIL SAMPLING  
 DATA CONTAINED IN THE RX, AND ON  
 DATA CONTAINED IN THE PHE.



**FIGURE A - 3**  
**UPPERBOUND LIFETIME**  
**CANCER RISKS IN SOIL**  
 DEPTH: 4-6 FT.  
 SUMMIT NATIONAL FS



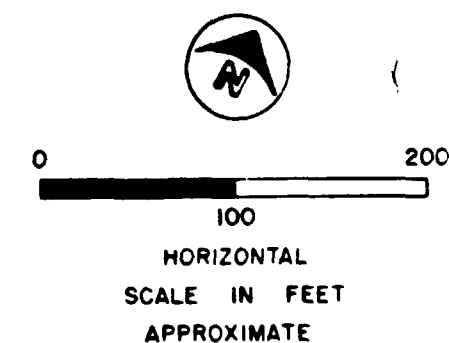
**LEGEND**

ND NONE DETECTABLE

NT NOT TESTED

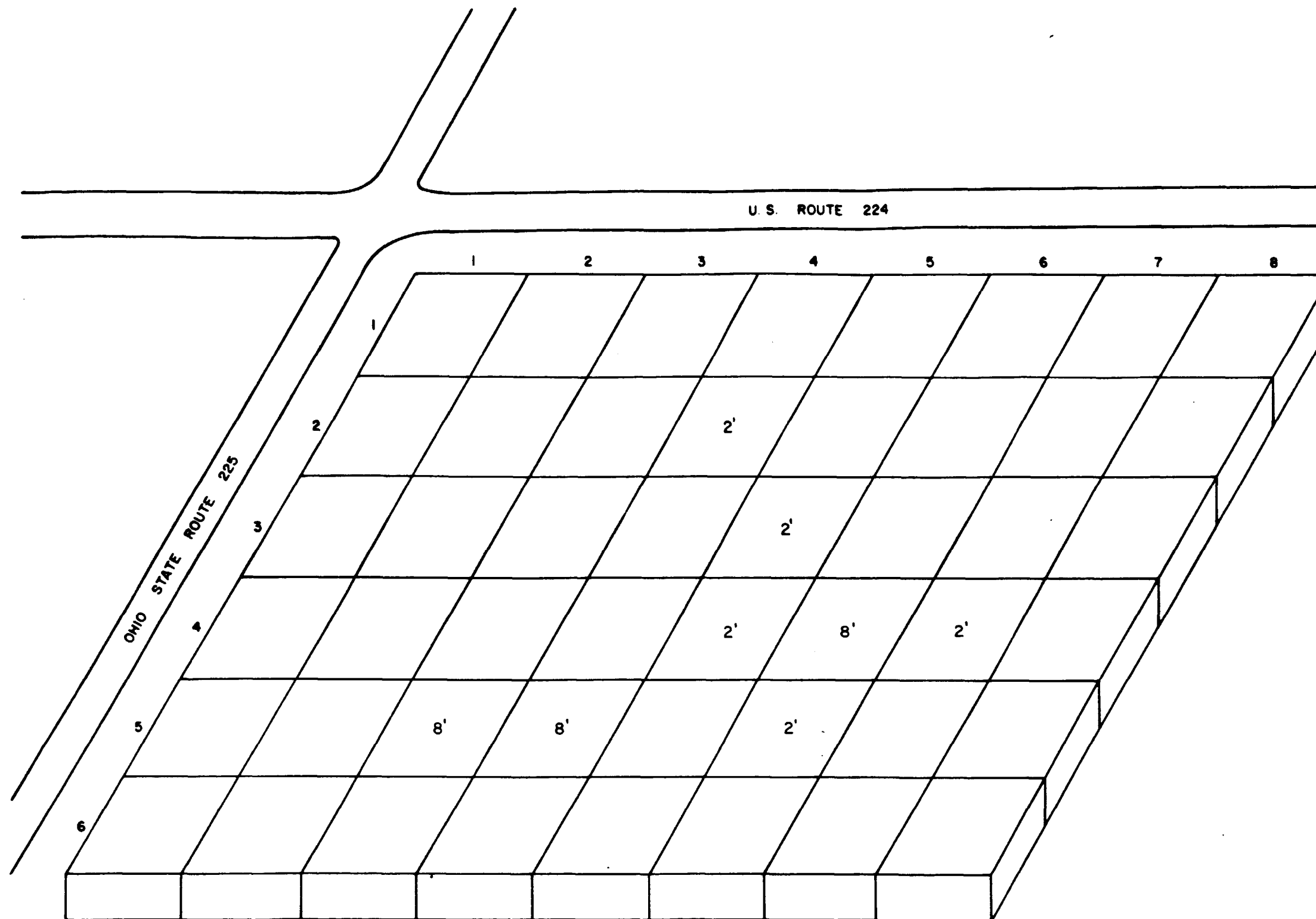
$1 \times 10^{-6}$  UPPERBOUND LIFETIME CANCER RISK

NOTE : RISKS BASED ON DATA PRESENTED IN TABLE 3-2 OF THE FS, SOIL SAMPLING DATA CONTAINED IN THE RI, AND ON DATA CONTAINED IN THE PHE.

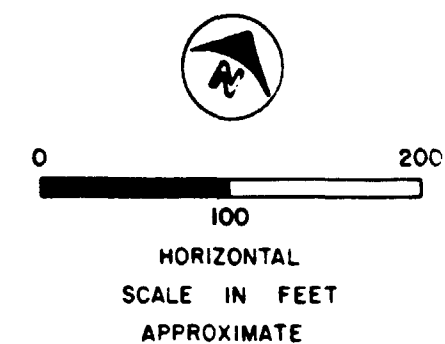


**FIGURE A - 4**  
**UPPERBOUND LIFETIME**  
**CANCER RISKS IN SOIL**  
 DEPTH: 6-8 FT.  
 SUMMIT NATIONAL FS



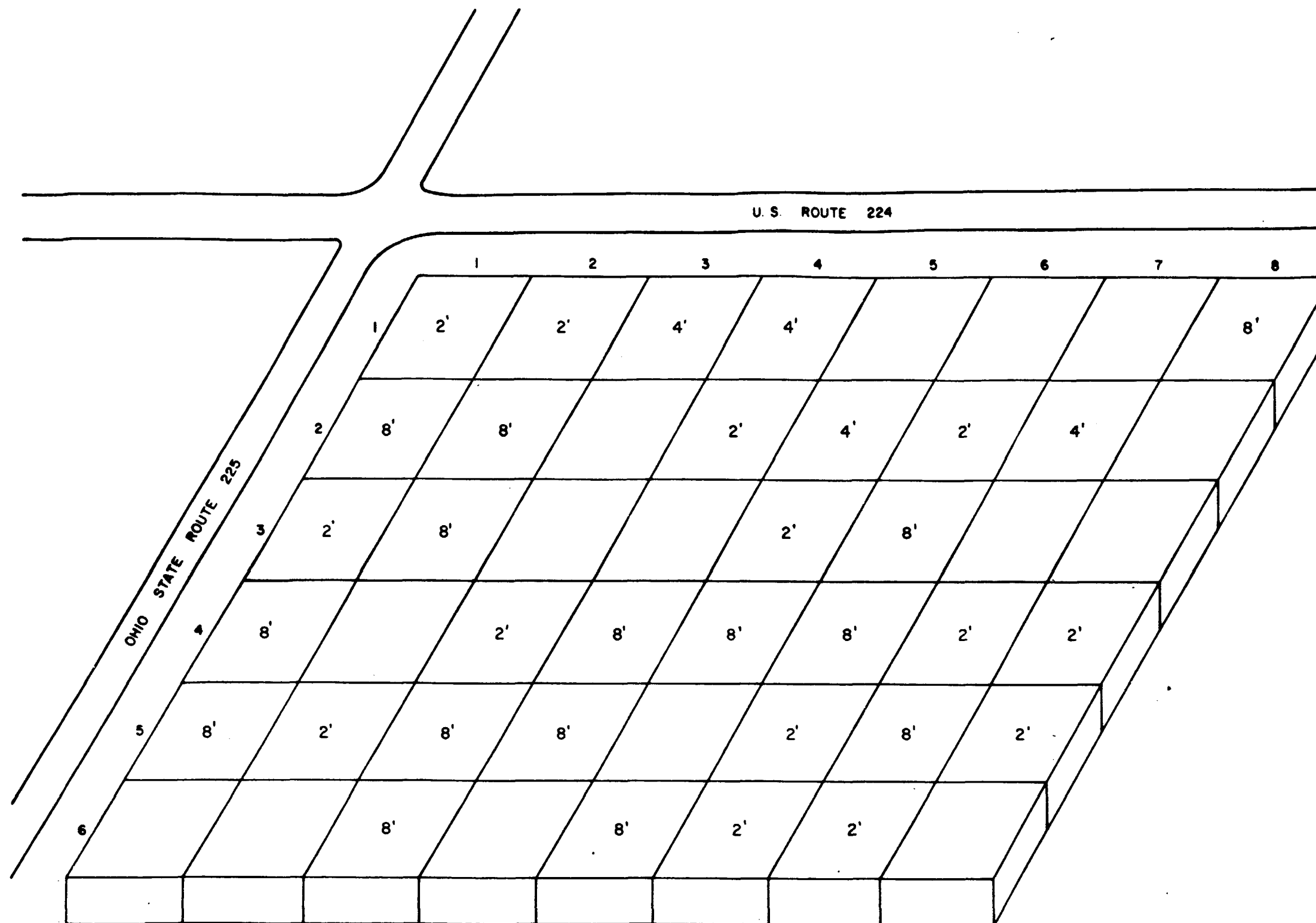


**LEGEND**  
 2' LOWERMOST DEPTH  
 AT WHICH INDICATED  
 CANCER RISK OCCURS

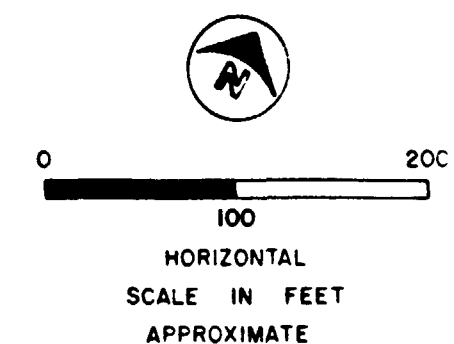


NOTE : FIGURE DEVELOPED FROM DATA  
 PRESENTED ON FIGURES  
 A - 1 THROUGH A - 4

FIGURE A - 5  
 DEPTH OF LOWEST  
 SOIL BLOCK WHERE  
 UPPERBOUND LIFETIME CANCER  
 RISK IS  $10^{-4}$  OR GREATER  
 SUMMIT NATIONAL FS

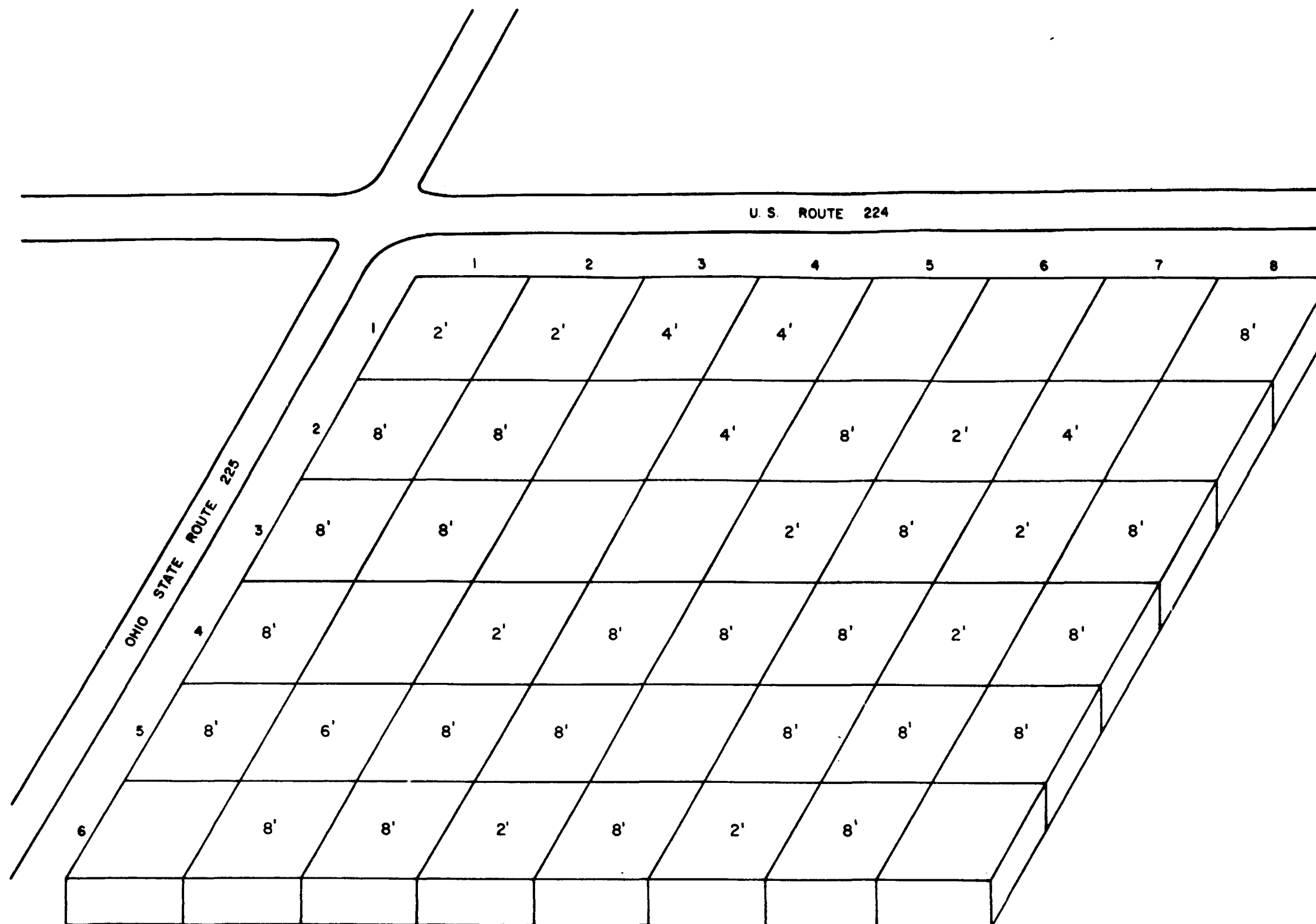


**LEGEND**  
 2' LOWERMOST DEPTH  
 AT WHICH INDICATED  
 CANCER RISK OCCURS



NOTE : FIGURE DEVELOPED FROM DATA  
 PRESENTED ON FIGURES  
 A - 1 THROUGH A - 4

FIGURE A-6  
 DEPTH OF LOWERMOST  
 SOIL BLOCK WHERE  
 UPPERBOUND LIFETIME CANCER  
 RISK IS  $10^{-5}$  OR GREATER  
 SUMMIT NATIONAL FS



**LEGEND**  
 2' LOWERMOST DEPTH  
 AT WHICH INDICATED  
 CANCER RISK OCCURS

NOTE : FIGURE DEVELOPED FROM DATA  
 PRESENTED ON FIGURES  
 A-1 THROUGH A-4

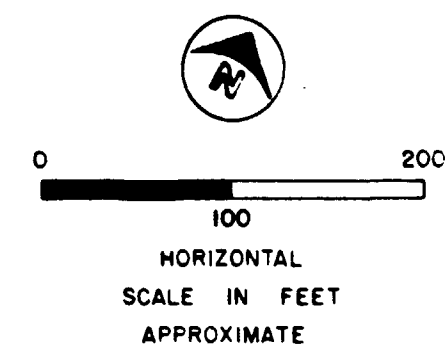
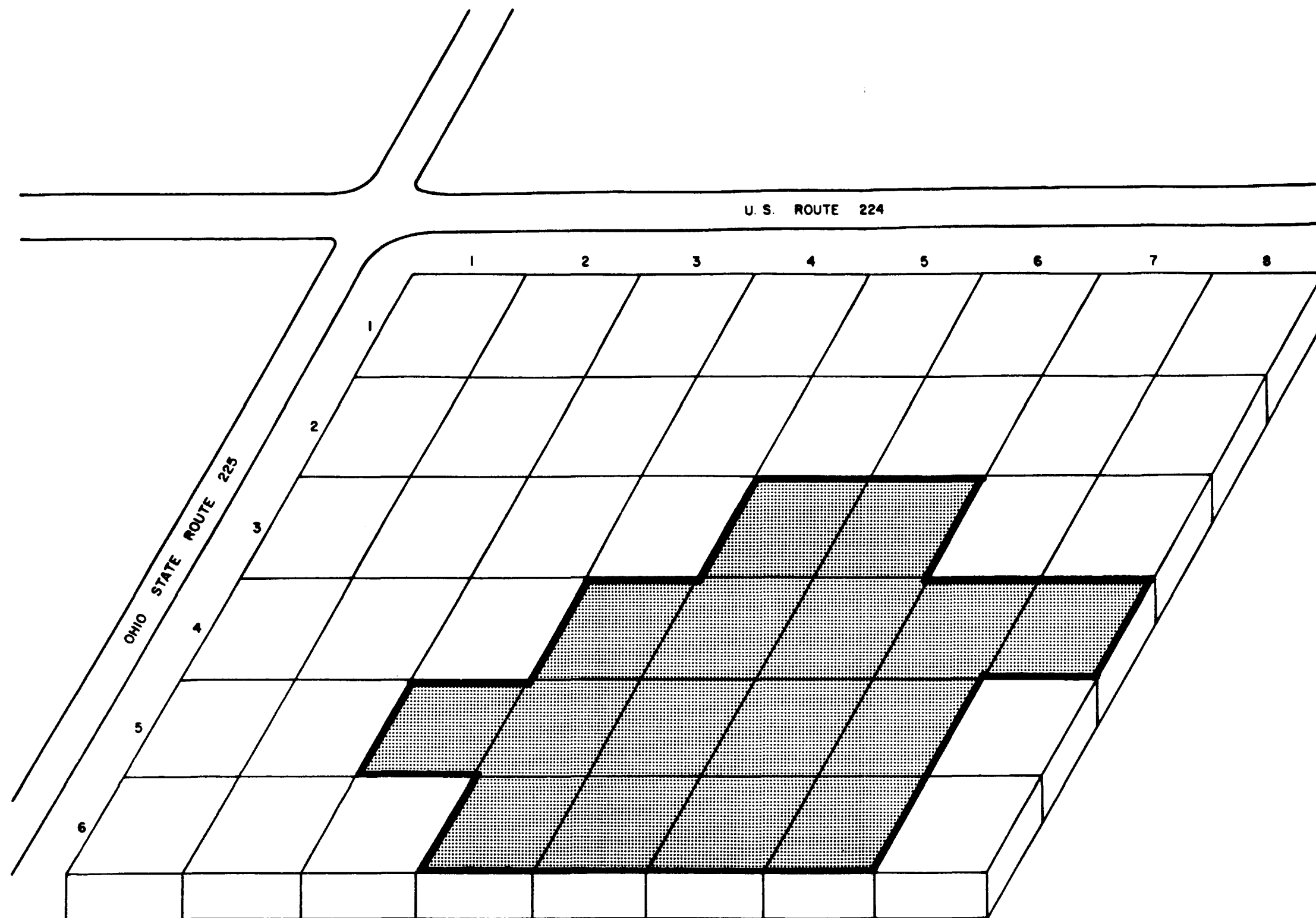
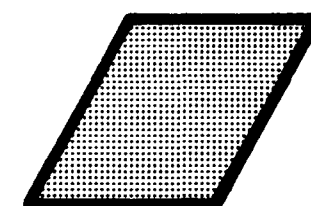


FIGURE A - 7  
 DEPTH OF LOWERMOST  
 SOIL BLOCK WHERE  
 UPPERBOUND LIFETIME CANCER  
 RISK IS  $10^{-6}$  OR GREATER  
 SUMMIT NATIONAL FS



**LEGEND**



SOIL BLOCK  
INCLUDED IN  
REMOVAL  
SCENARIO



HORIZONTAL  
SCALE IN FEET  
APPROXIMATE

FIGURE A-8  
SOIL BLOCKS INCLUDED IN  
"HOT SPOT" SOIL  
REMOVAL SCENARIO  
SUMMIT NATIONAL FS

- b. Chemical Concentrations in Soils/Health Risks: Data presented on Figures A-1 through A-4 developed from soil chemical concentration data, indicate that a number of soil blocks within the delineated hot spot area (shown on Figure A-8), specifically Blocks 4-5 and 4-6 (north-south block number first, east-west block number second) present the highest upperbound lifetime cancer risks of any soil blocks analyzed.
- c. Estimated Residual Cancer Risk: Those soil blocks not included in the hot spot soil removal scenario were analyzed to estimate the resulting cancer risk from not remediating those blocks. This analysis was performed by calculating the geometric mean of the indicator chemical concentrations remaining in unremediated soil blocks, and comparing the cancer risk concentrations presented in FS Table 3-2. Our analysis indicated that the highest risks associated with not remediating these blocks were due to the concentrations of PCBs and PAHs.

The estimated overall upperbound lifetime cancer risk associated with soils not removed in this scenario is  $3 \times 10^{-5}$ .

Based on the data presented above, it was decided to retain and evaluate the hot spot removal scenario. This scenario provided an increased level of protection by reducing the upperbound lifetime cancer risk associated with the site from  $2 \times 10^{-4}$  to  $3 \times 10^{-5}$ .

2. Vadose Soil Removal Scenario: A more protective soil removal scenario than the hot spot soil removal alternative was developed which included the removal of all soil blocks for which an upperbound lifetime cancer risk of  $10^{-6}$  or greater was estimated. This removal scenario was developed by identifying the maximum depth at which each soil block possessed a  $10^{-6}$  risk level, and including all soil in the block to that depth in the scenario. Depths at which the  $10^{-6}$  risk level were estimated for each soil block are shown on Figure A-7. It was estimated that approximately 85,000 cu. yds. of soil would be removed in order to satisfy the goal of reducing the residual cancer risk to less than  $10^{-6}$ , based on the data as shown on Figure A-7.

The soil blocks which would remain due to less than  $10^{-6}$  risk levels were scattered throughout the site, and were not contiguous. It was estimated that a significant portion of the cost savings realized by not removing these soil blocks would be offset by increased construction costs associated with having to work around these blocks (improved implementability). For this reason, it was decided that the entire contaminated vadose soil unit (105,000 cu. yds.) would be included for removal in this scenario, rather than only selected soil blocks.

3. Removal of All Contaminated Unconsolidated Material to Bedrock: USEPA requested that the removal of all unconsolidated materials to bedrock be evaluated. This removal scenario was intended to represent the maximum level of protection that could be achieved by soil remediation by including the removal of all contaminated materials. It was estimated that this soil removal volume would be approximately 430,000 cu. yds.



## Appendix B

## APPENDIX B

### GROUNDWATER REMEDIATION

#### BACKGROUND

During the Remedial Investigation (RI), it was concluded that the groundwater system in the uppermost 140 feet of strata beneath the Summit National Site could be divided into three hydrogeologic units, which were assigned informal names for the purposes of the RI: a Water-Table Aquifer, a series of Intermediate Units, and the Upper Sharon aquifer. The Water-Table aquifer occurs in the fill, till, mine spoil, and very shallow bedrock. Beneath the area of waste disposal, the flow in the Water-Table Aquifer is southward and southeastward. The Water-Table elevation in this area ranges from 1085 to 1090 feet msl. The base of the aquifer occurs at an elevation of approximately 1060 to 1065 feet msl. The hydraulic conductivity of the unconfined zone ranges from  $3 \times 10^{-3}$  to  $1 \times 10^{-5}$  cm/sec, with a logarithmic mean of  $4 \times 10^{-4}$  cm/sec. Based upon this range and the September 1986 water-table configuration, the quantity of groundwater flow beneath the site in the Water-Table Aquifer is estimated at 2,000 to 68,000 gpd, with a darcian velocity of 0.02 to 0.7 ft/day. The majority of flow in the water-table aquifer is moving horizontally. A variety of organic contaminants have been identified in this aquifer, particularly in the area of waste disposal.

The Intermediate Units are comprised of a sequence of highly heterogeneous but generally less permeable strata, immediately underlying the Water-Table Aquifer. The siltstones, shales, silty sandstones, limestones, and coals of the Intermediate Units have an average total thickness of approximately 60 feet. Lateral flow in these strata is insignificant when compared to vertical flow, so that vertical flow predominates. The direction of this vertical flow varies from upward at the extreme southern edge of the site, to downward at the central portion of the site. Hydraulic conductivities range from  $6 \times 10^{-7}$  to  $6 \times 10^{-5}$  cm/sec, with most of the values falling within the range  $6 \times 10^{-6}$  to  $6 \times 10^{-5}$  cm/sec. Using these values and assuming a value of 1:10 for the ratio of vertical to horizontal hydraulic conductivity, the flow downward through this unit beneath the area of waste disposal is estimated at 1,400 to 4,700 gpd (RI Section 4.3.2), at a velocity of less than 0.2 ft/day. One monitoring-well cluster completed in this zone in the central portion of the site detected contaminants to a depth of 68 feet below grade.



The Upper Sharon aquifer is a somewhat more permeable zone which occurs immediately beneath the intermediate units, in the upper member of the Sharon Formation. This zone is also heterogeneous, although it is generally more coarse-grained than the intermediate units. The direction of groundwater flow in this zone beneath the area of waste disposal is northward. The piezometric surface ranges from 1063 to 1067 feet msl. Hydraulic-conductivity estimates range from  $1 \times 10^{-5}$  to  $3 \times 10^{-4}$  cm/sec. Flow beneath the site in the upper 45 feet of the upper Sharon aquifer is estimated at 250 to 1,500 gpd. The velocity of this flow is estimated at 0.01 to 0.06 ft/day. The RI concluded that water quality in the upper Sharon aquifer was not affected by site contaminants.

Based on the data collected during the RI, the various units encountered at the Summit National Site could be remediated as follows:

- o Water Table Aquifer: Since the majority of the flow is moving horizontally in this aquifer, vertical cutoffs with gradient control are most feasible.
- o Intermediate Unit: Since vertical flow predominates in this aquifer and this aquifer is a bedrock unit, typical cutoff methods are infeasible. Gradient control will have to be used to control groundwater movement.
- o Upper Sharon: No remediation is necessary.

#### GRADIENT CONTROL

During the initial stages of the Feasibility Study, it was determined that the materials of the Water-Table Aquifer were permeable enough to facilitate typical groundwater withdrawal techniques, such as french drains and pumping wells, for aquifer renovation. However, the materials of the Intermediate Units are not as permeable, so that removal of contaminated groundwater by pumping would not be practical. The hydraulic conductivity of the Intermediate Units was estimated in the  $10^{-7}$  to  $10^{-5}$  cm/sec range, and expected well yields would be under 1 gpm. Technology for installing this type of well in bedrock has not been developed.

However, it would be possible to stagnate vertical flow in the intermediate units by lowering the head in the Water-Table Aquifer to equal that in the Upper Sharon aquifer, thereby reducing the hydraulic gradient across the Intermediate Units to zero (Figure B-1). At the center of

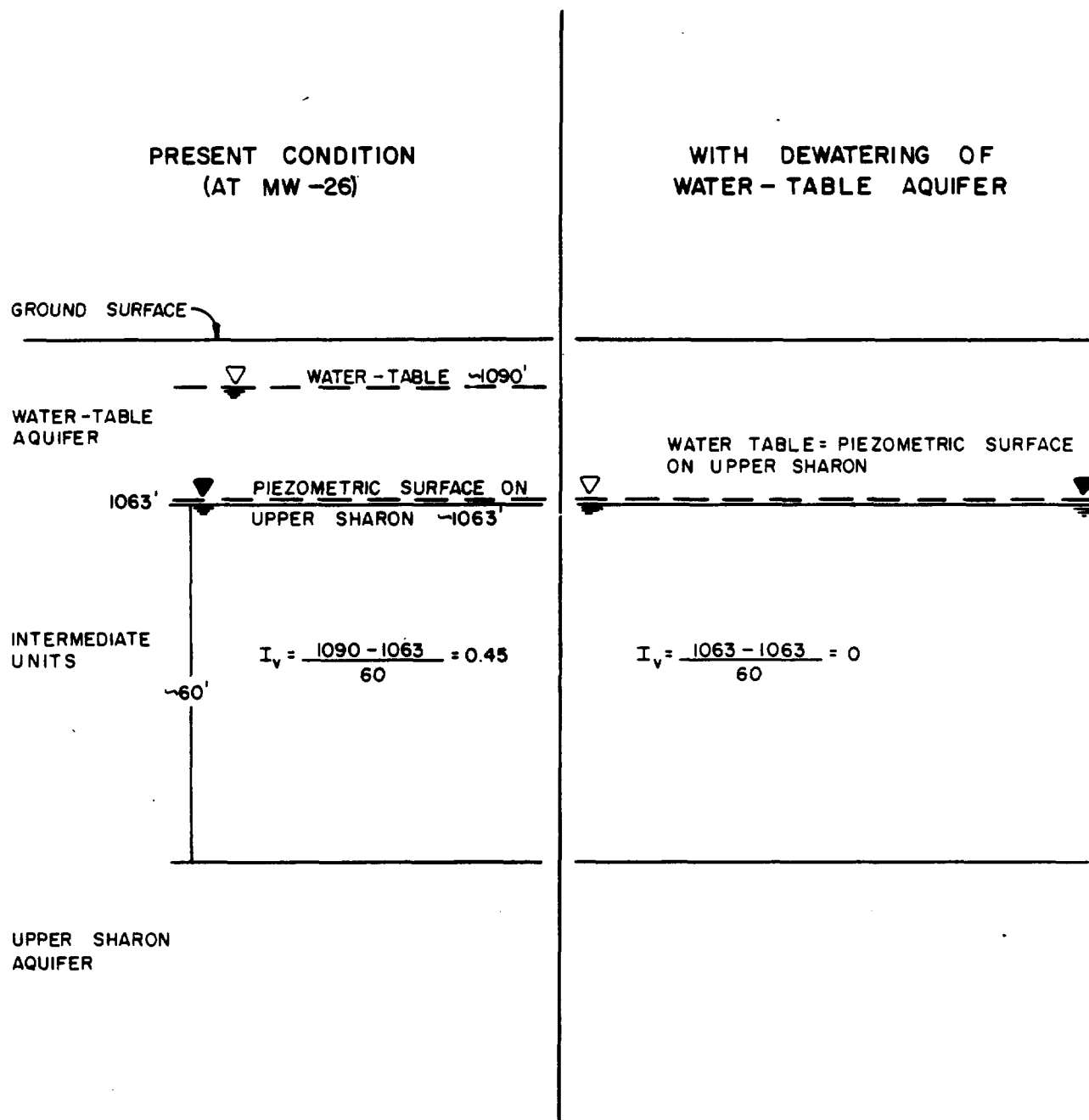


FIGURE B-1  
SCHEMATIC DIAGRAM OF  
VERTICAL GRADIENTS  
SUMMIT NATIONAL FS

the site, the elevation of the base of the Water-Table Aquifer is approximately the same as the piezometric surface on the Upper Sharon aquifer (1063 feet msl), so complete dewatering of the Water-Table Aquifer can reduce the vertical hydraulic gradient across the Intermediate Units to zero.

In the extreme southern portion of the site, the base of the Water-Table Aquifer is slightly lower and the piezometric surface on the Upper Sharon is slightly higher, so some gradient reversal could be accomplished. However, because dewatering the Water-Table Aquifer may lower the head on the Upper Sharon by decreasing recharge, the use of present data to calculate the post-dewatering gradient would result in an overestimated value. Also, the dewatering process may not be 100% efficient, so that the actual head in the Water-Table Aquifer may remain slightly above the base of the aquifer. For these reasons, it should be assumed that the gradient in the Intermediate Units can be decreased to a value approaching zero, but cannot practicably be reversed.

Dewatering of the Water-Table Aquifer will eliminate some recharge to the Upper Sharon aquifer. If the head on the Upper Sharon were lowered by the dewatering of the Water-Table Aquifer, the desired stagnation of groundwater in the Intermediate Units may not be attained. Calculations presented in the RI indicate that the Water-Table Aquifer is a significant source of recharge to the Upper Sharon, but these calculations are order-of-magnitude estimates only. The recharge area available to the Upper Sharon is much larger than the site, and it would intuitively appear that removal of recharge from the site should not affect the overall hydrologic regime of the Upper Sharon aquifer. The possibilities of this must be further addressed with pump tests before detailed design and implementation of this alternative.

#### CONCEPTUAL DESIGN OF DEWATERING SYSTEM

Calculations for conceptual design of a system to dewater the Water-Table Aquifer are detailed in Appendix C. These calculations are based on data collected during the RI which indicated that the onsite materials exhibited a wide range of hydraulic conductivity values. A system to dewater the water table aquifer would require five to seven lined french drains extending across the site or an indeterminate number of wellpoints to simulate drains. The initial discharge rate could be between 2 and 900 gpm; but, based upon the log-mean permeability, would probably be in

the range of 10 to 100 gpm. If a slurry wall and clay cap were installed, the discharge rate would decline logarithmically through time, finally being limited to the quantity of water which could pass through the cap and slurry wall. If both the cap and slurry wall were constructed with a hydraulic conductivity of  $10^{-7}$  cm/sec., the ultimate discharge of the system would be less than 2 gpm.

For purposes of the FS, a network of 220 wells installed on a 50 ft. grid over the site collectively pumping 30 gpm was assumed. The exact number, spacing, and pumping rate for the wells would have to be refined by performing in-field pumping tests for final design. Given this pumping rate and the installation of a cap and slurry wall, it should take 2 to 10 years to fully dewater the onsite Water-Table Aquifer.

#### GROUNDWATER CLEANUP

Cleanup of the groundwater within the Water-Table Aquifer (contaminants associated with soils below the water level) will not occur since the system discussed in this Appendix does not allow water that could flush out the contaminants to flow through the aquifer. The only water passing through this area will be the nominal seepage through the cap or the slurry wall. If water was allowed to flow through the Water-Table Aquifer, the Intermediate Unit flow could not be stagnated.

Cleanup of the Intermediate Unit could occur within 5 to 10 years after system startup based on data obtained during the RI.

#### CONCLUSION

The most feasible remedial alternative for groundwater remediation would be dewatering of the Water-Table Aquifer. This alternative would directly remediate groundwater contamination in the unconfined zone, while potentially stagnating contaminant migration in the Intermediate Units.



## APPENDIX C

### GRADIENT CONTROL/DEWATERING CONCEPTUAL DESIGN

Data generated during the Remedial Investigation were used to develop the conceptual model of the groundwater system at the Summit National Site, as well as the estimates of groundwater withdrawal volumes contained herein. These data included boring logs, water levels, and hydraulic conductivities estimated from single-well recovery tests. Withdrawal calculations were performed using simple analytical solutions. Calculations assume homogeneous, isotropic conditions, a saturated aquifer thickness of 30 ft., no recharge other than underflow, fully penetrating drains or wells. Another possible source of error is the absence of pumping data from which to estimate radii of influence or specific capacities of wells and drains.

#### 1. DRAINS

Calculation of drawdown by french drains was performed using an equation for drawdown due to a slot of finite length in an unconfined aquifer (Navy NAVFAC P-418, 1983):

$$H^2 - h^2 = \frac{L - y}{L} (H^2 - h_e^2)$$

$$Q = \frac{Kx}{2L} (H^2 - h_0^2)$$

where:

Q = flow

H = initial saturated aquifer thickness

K = hydraulic conductivity

h = saturated aquifer thickness at distance y

$h_0$  = saturated aquifer thickness in the slot

$h_e$  = saturated aquifer thickness at the edge of the slot

L = distance of influence for the slot.

This equation describes drawdown due to a single drain. Effects of multiple drains were determined by superposition. Effects of slurry walls were simulated by the use of image drains.

Data were unavailable for calculation of L, but repeated calculations with varying values for L indicated that a value of 200 feet would be reasonable for most situations. The resultant system would be overdesigned for L values greater than 200 feet.

Calculations ignored recharge, so flow quantities must be adjusted when calculating actual withdrawal rates. The method also assumes the removal of the onsite ponds. A system of seven drains appeared to create sufficient drawdown. A drain length of 600 feet was used. Successive calculations for different drain spacings indicated that a drain spacing of 75 ft. should be sufficient for most likely field conditions.

This system would result in complete dewatering of the system at the interior drains for L values of greater than or equal to 200 feet. For L = 100 feet, the maximum drawdown would be 19 feet at the center drain. For L values of 100 to 200, the expected discharge rates would be:

10 - 100 gpm if  $K = 4 \times 10^{-4}$  cm/sec (log-mean estimate)  
90 - 900 gpm if  $K = 3 \times 10^{-3}$  cm/sec (high-end estimate)  
2 - 30 gpm if  $K = 1 \times 10^{-5}$  cm/sec (low-end estimate).

## 2. WELLS

Lines of well points could be used to simulate the drains. The wells would have to be spaced closely enough to interfere with one another to create groundwater troughs. Data are insufficient to calculate exact spacings, but wells would probably have to be less than fifty feet apart. Effect on water levels and total groundwater withdrawal from a well-point system would be the same as for a drain system, provided that the wellpoints were spaced properly. Test pumping would have to be performed to determine the final interwell spacing.

Reference: Navy NAVFAC P-418. Dewatering and Groundwater Control, November 1983.